THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

VOL. XIX. No. 469—22ND YEAR.] LONDON, SEPTEMBER 27, 1870. [Subscription { 15s. in Advance. / 16s. Credit.] Price 8d. Unstamped.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—
10,000 cubic feet of gas per ton of coal.
26-candle gas.
13¼ cwt. coke per ton of coal.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.

RAMSAY'S FIRE-CLAY ARTICLES.
GAS-RETORTS, introduced 1828.
FIRE-BRICK WORKS, established 1804.
FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay.
The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article.
The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubit Town. Large stocks kept.
Address G. H. RAMSAY, NEWCASTLE-ON-TYNE.

GEORGE GLOVER & CO.,
Patentees of the Standard Gasometers for the Government, and of the
IMPROVED DRY GAS-METERS.
These Meters are warranted to measure correctly and not to vary, and have come into general use more rapidly than any Meters hitherto manufactured.

PARIS EXHIBITION, 1867.
THE TESTING-HOUSE REPORTS.
The Reports prepared for the Science and Art Department, under the direction of the Lords of the Council, detail the arrangements made for testing the gas apparatus exhibited. In the testing-house erected by the Special Committee appointed to further this object a gasholder was constructed by Mr. G. Glover, being a *fac simile* of that produced and patented by him in 1860, and deposited in the Exchequer, under the provisions of the Sales of Gas Act, and British manufacturers of gas apparatus were invited by advertisement, and by direct application, to forward worthy objects for exhibition. Mr. G. Glover was, however, the only manufacturer who sent Meters to be tested. The report states that, as "Mr. Glover is a manufacturer of Dry Meters only, no opportunity presented itself of comparing their accuracy with that of Wet Meters under various circumstances, but the perfection to which that maker has brought his Meters prevents the possibility of those extravagant errors which are well known to exist where Wet Meters are used."
Particulars and lists of prices forwarded on application to Ranelagh Works, Ranelagh Road, Pimlico, LONDON, S.W.; 15, Market Street, MANCHESTER; or 127, Boulevard de Magenta, PARIS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, NEAR NEWCASTLE-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they have also been awarded in the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts in the United Kingdom; and orders for Fire-Clay Retorts of all shapes and dimensions, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Coal Office,
QUAY SIDE, NEWCASTLE-ON-TYNE.

FIRST PRIZE IN THE PARIS EXHIBITION.
JOHN RUSSELL and CO.,
THE OLD TUBE-WORKS,
CHURCH HILL, WEDNESBURY;
ALMA WORKS,
WALSALL, STAFFORDSHIRE;
and 69, UPPER THAMES STREET, LONDON,
Original Manufacturers of Wrought-Iron Gas-Tubes, and Holders of the present Patents; Inventors and First Makers of LAP-WELDED FLUES for Steam-Boilers.
J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water, and the largest orders may be executed in a few days.
Gun Metal, and all other kinds of Cocks, Stocks, Dies, and Taps, Galvanized Tubes, &c.
N.B.—All goods thoroughly tested before sent out, and warranted.

JOHN BENT & SON,
WET AND DRY GAS-METER
AND
STREET-LAMP
MANUFACTURERS,
BELL BARN ROAD, BIRMINGHAM.
ESTABLISHED 1830.
All materials found for the alteration of Public Lamps for lighting with the Rod. Regulators with Lava Burners.

BLAYDON BURN AND LOW BENWELL FIRE-CLAY RETORT AND FIRE-BRICK WORKS,
NEAR NEWCASTLE-ON-TYNE.
WILLIAM COCHRAN CARR begs most respectfully to thank the Metropolitan, Provincial, and Continental Gas Companies for their patronage for several years past, and to intimate that he has rebuilt and enlarged his extensive premises for the manufacture of CLAY RETORTS; and that he is now prepared to execute the largest orders with punctuality and despatch. Orders for FIRE-CLAY RETORTS, of all shapes and sizes, FIRE-BRICKS, and all other articles in Fire-Clay, executed on the shortest notice, and on the most reasonable terms.
London Agents: JAMES LAWRIE & CO.,
63, OLD BROAD STREET, CITY, LONDON.

CANNEL COAL FACTORS.
J. & W. ROMANS, of Edinburgh and London, in returning thanks for the confidence hitherto reposed in them, beg to intimate that they have exended their Colliery connexion for the supply of SCOTTISH CANNELS, and have taken a lease of the CROWN WHARF, LIMEHOUSE CUT, LONDON, where these rich Coals can be obtained at the lowest prices.
Messrs. ROMANS, being lessees of several Gas-Works in Scotland, have their Cannels tested in the ordinary working-process-way of gas-making, thus securing for their customers additional guarantee, beyond mere laboratory experiments.
Contracts made to supply any quantity, and analysis sent, on application to the Offices, 53, Frederick Street, EDINBURGH, or 1, Walbrook, Mansion House, LONDON.
Shippers of steam and house Coal, entered on the Government list. Freightage secured on best terms.

LESMAHAGO GAS COAL,
AUCHINHEATH COLLIERY.
LESMAHAGO N.B.

JAMES FERGUSON & CO.
LESSEES SINCE 1832.
LONDON AGENTS:
JAMES LAWRIE & CO.,
63, OLD BROAD STREET, E.C.
CONTINENTAL AGENTS:
LA COUR & WATSON,
LEITH.

CROLL'S DRY GAS-METER,

PRIZE MEDALS.
LONDON, 1851;
NEW YORK, 1853;
PARIS, 1855.

(INVENTED & PATENTED IN 1844,)
COMBINING ALL THE LATEST IMPROVEMENTS,
MANUFACTURED ONLY BY

PRIZE MEDALS.
LONDON, 1862;
DUBLIN, 1865;
PARIS, 1867.

THE GAS-METER COMPANY, LIMITED
238, KINGSLAND ROAD, LONDON, N.E.
A. ANGUS CROLL, C.E., Chairman. GEORGE RAIT, Managing Director.

MEDAL AWARDED, EXHIBITION, 1862, "FOR GOOD WORK."
THE IMPERIAL TUBE COMPANY, BIRMINGHAM,
MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS, BRASS & COPPER TUBES,
GALVANIZED & GLASS ENAMELLED TUBES & FITTINGS,
LAP-WELDED IRON & BRASS BOILER-TUBES, ETC., ETC.
Twyere Coils for Blast Furnaces, Boring Tubes, Core Bars, Gun-Metal and other Cocks, Boiler Mountings &c.
HUGHES'S PATENT TAPS FOR HIGH PRESSURES.

JOURNAL OF GAS LIGHTING NEWSPAPER ONE PENNY

HENRY HOWARD & CO.,

COOMBS WOOD PATENT TUBE-WORKS,

OLD HILL, near DUDLEY,

MANUFACTURERS OF

HOWARD'S PATENT IMPROVED WROUGHT-IRON TUBES,

FOR GAS, STEAM, AND WATER;

Also ORDINARY WELDED WROUGHT-IRON TUBES and FITTINGS,

FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.

CORE BARS FOR IRONFOUNDERS, STOCKS, TAPS, AND DIES, IRON COCKS, &c.

London Agent—W. G. DAVIS, 2, Brabant Court, Philpot Lane, E.C.

SILVER MEDAL, PARIS EXHIBITION, 1867.

LLOYD AND LLOYD,

ALBION TUBE-WORKS, BIRMINGHAM,

MANUFACTURERS OF

WROUGHT-IRON TUBES AND FITTINGS

For Gas, Steam, Water, &c.

SOLE LICENSEES for the United Kingdom for the LAVENANT PATENT ENAMELLED TUBES & FITTINGS,

the Coating of which does not shell off, is a certain preservative from rust, and resists all effects of expansion and contraction.

LAP-WELDED IRON & HOMOGENEOUS METAL TUBES

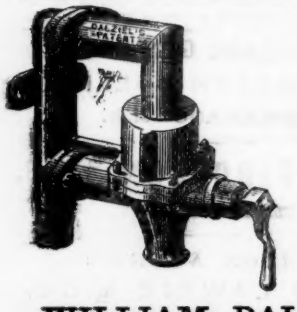
For Locomotive, Marine, and Stationary Boilers.

Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools of all kinds.

London Offices: No. 4, Cloak Lane, Queen Street, E.C.

WAREHOUSES:

LONDON: No. 157, Upper Thames Street, E.C. **LIVERPOOL**: No. 63, Paradise Street. **MANCHESTER**: Barlow's Croft, Chapel Street, Salford. **PARIS** and **LILLE**.



IMPORTANT TO WATER COMPANIES, BUILDERS, &c.

DALZIEL'S PATENT

COMBINED COCK AND VALVE,

OR POSITIVE WASTE OF WATER PREVENTER.

Its simplicity, cheapness, strength, durability, and compactness recommend it for every domestic purpose. By its adoption Water Companies will be enabled to give a constant supply to the public, with certainty that no waste can take place.

To be seen daily in operation at 13, Crooked Lane, King William Street, E.C., from Eleven to Twelve.—For price and particulars apply to

WILLIAM DALZIEL, ENGINEER, CREEK ROAD, DEPTFORD, S.E.

E. J. & J. PEARSON,

DELPH & TINTAM ABBEY FIRE-CLAY & BRICK WORKS,

STOURBRIDGE,

PROPRIETORS OF

BEST GLASS-HOUSE POT & CRUCIBLE CLAY;

MANUFACTURERS OF

GLASS-HOUSE POTS, CRUCIBLES, GAS-RETORTS, & FIRE-BRICKS OF EVERY DESCRIPTION.

TRADE MARK.

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.;

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

IMPROVED CONSUMERS GAS-METERS,

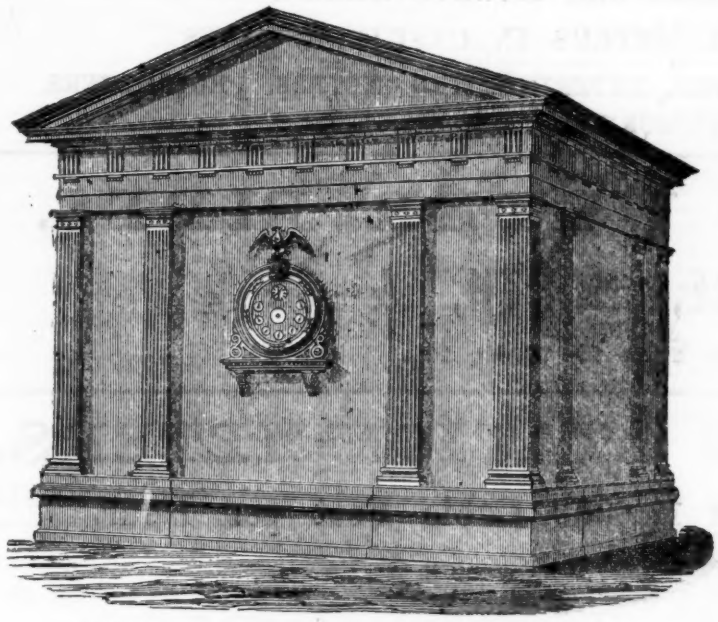
Of the best material and workmanship, carefully adjusted to the requirements of the British Sales of Gas Act and Foreign Standards of Measures.

PATENT FIXED WATER-LINE GAS-METERS,

Which are uniform with the ordinary Meters, and register with minute accuracy.

IMPROVED DRY GAS-METERS,

IN BEST TINNED IRON CASES.



GAS STATION-METERS,

WITH PLANED JOINTS.

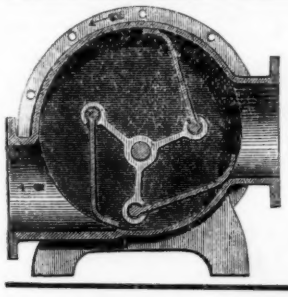
GOVERNORS, GAUGES, INDICATORS, EXHAUST-GOVERNORS, &c.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c., ON APPLICATION.



CHARLES HORSLEY'S

PATENT

GAS EXHAUSTER.

(From 250 Feet upwards per Hour.)

Also,

ROTARY TAR AND OIL PUMPS.

For particulars and prices apply to the Patentee,

22, Wharf Road, City Road, London, N.

CONDENSER & PURIFIERS FOR SALE.

ONE Set of 3 Dry Lime Purifiers, 6 ft. by 6 ft., and 3 ft. 9 in. deep, with 6-in. connexions, wet centre-valve, wood grids, and lifting apparatus all in good working order. Also One CONDENSER, with 16 5-in. pipes, each 12 ft. long, top and bottom syphon-boxes, and 7-in. connexions; together with a Station-Meter to pass 2000 feet per hour, and an Hydraulic Main 20 ft. long by 14 in. diameter, with 9 4-in. bridge-pipes. The above will be sold either in one lot or separately, and no reasonable offer refused. JOHN CREW, Manager.

Gas-Works, Blackpool, Lancashire,
Aug. 20, 1870.

BRONNER'S PATENT GAS-BURNERS give 99 per cent. of light, as compared with 27 per cent. given by ordinary burners, with equal consumption of gas.—*Vide* "Gas Referees Report," published June, 1869.

HENRY GREENE AND SON, Sole Consignees of Brönner's Patent Improvements in Gas Lighting, 16 and 17, King William Street, E.C., and 138, Regent Street, LONDON. Agents wanted.

ROBERT MACLAREN and CO.,
EGLINTON FOUNDRY, GLASGOW,
Manufacturers of all sizes of Cast-Iron Main-Pipes by an improved Patent, General Ironfounders, Gas Engineers, and Wrought-Iron Tube Makers.

ALFRED LASS,

ACCOUNTANT.

28, NORTH STREET, WANDSWORTH, S.W.

Mr. Alfred Lass having had considerable experience in arranging, making up, balancing and auditing gas accounts, begs to inform the Directors of Gas Companies that he may be consulted on all matters relating thereto.

Balance-sheets prepared, Accounts audited, Consultations, Agencies, &c.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c., &c.,

SCOTSWOOD FIRE-BRICK WORKS,
NEAR
BLAYDON-ON-TYNE.

B. CARPENTER'S

IMPROVED

WOOD SIEVES FOR GAS PURIFIERS.

WORKS:

14, JOHN STREET, PENTONVILLE ROAD,
LONDON, N.

The above Sieves are used by the principal Gas Companies in London and the country. Their utility, durability, and cheapness combined, render them superior to all others.

Testimonials from Gas Engineers who have tested their qualities forwarded on application.

All orders punctually attended to, and estimates given if required.

Established 1811.

READY & SON,

BILSTON STREET BRASS FOUNDRY,

WOLVERHAMPTON

MANUFACTURERS OF

SUN BURNERS, GAS CHANDELIERS,
HALL LANTERNS, BRACKETS, PENDANTS,
And every Description of
GAS-FITTINGS,
Including
MEDIÆVAL FITTINGS FOR CHURCHES, &c

Large Pattern-Books complete, with Book of Prices, 7s. 6d.

SWANWICK CANNEL.

The yield of this Cannel is liberal, the illuminating power large, and coke good.

For prices and terms, apply to

H. BOAM, 1, Darwin Terrace, DERBY.

WILLIAM INGHAM AND SONS,

WORTLEY FIRE-BRICK AND RETORT WORKS,

Near

Leeds.

W. INGHAM and SONS, having for many years been extensively engaged in the Manufacture of

RETORTS AND FIRE-BRICKS FROM THE CELEBRATED WORTLEY FIRE-CLAY

beg to call especial attention to their RETORTS, which have for many seasons proved to be unsurpassed in quality by any in the Kingdom, their FREEDOM FROM CRACKS and the ADHESION OF CARBON rendering them worthy the attention of all parties interested in the making of Gas.

The Works are of such magnitude as to ensure the prompt execution of orders to any extent.

Estimates for Setting, or Bricklayers sent when required.

GAS OVENS IN SEGMENTS OF EQUAL QUALITY.

A large Stock of Fire-Bricks, Fire-Clay, Terra Cotta, and Drain-Pipes of all Sizes kept in London at Mr. ALFRED WILLIAMS, Wharf, 64, Bankside, Southwark, where all particulars of Prices, &c., may be obtained.

N.B.—*Export orders continue to have prompt attention.*

D. BRUCE PEEBLES & CO.,

ENGINEERS, WET AND DRY GAS-METER MANUFACTURERS,

BRASSFOUNDERS, & GAS APPARATUS MANUFACTURERS,

FOUNTAINBRIDGE WORKS, EDINBURGH.

SOLE MANUFACTURERS OF

Peebles' Patent Wet and Dry Gas-Meters in Tin-Plate Cases, with Tongue and Groove Joints.

IMPROVED WET METERS IN CAST-IRON CASES.

STATION-METERS, GOVERNORS, EXPERIMENTING METERS, PHOTOMETERS, PRESSURE-GAUGES, &c.

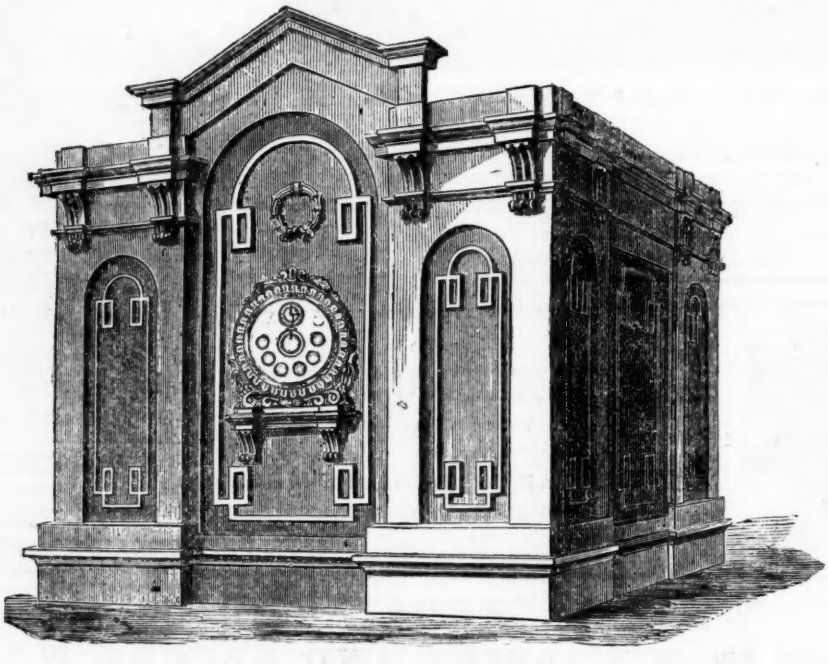
GAS AND WATER PIPES.

CLARIDGE, NORTH, & CO.,

BILSTON.

DESIGN FOR STATION-METERS.

From 45,000 to 120,000 Cubic Feet per Hour.



MANUFACTURED BY THE

GAS-METER COMPANY,

LIMITED,

LATE WEST & GREGSON, OLDHAM.

Meters of a similar design may be seen in operation in London, Manchester, Liverpool, Dublin, Oldham, Leeds, Bristol, Halifax, Salford, Stockport, Wolverhampton, Rochdale, Bradford, Bolton, Blackburn, and many other places.

Just Published, demy 8vo, half bound roan, cloth sides, lettered, price 7s. 6d., by post 8s.,

THE GAS MANAGER'S HANDBOOK,

CONSISTING OF

TABLES, RULES, AND USEFUL INFORMATION

FOR

GAS ENGINEERS, MANAGERS,

AND OTHERS ENGAGED IN THE

MANUFACTURE AND DISTRIBUTION OF COAL GAS.

By THOMAS NEWBIGGING A.I.C.E.

"An extremely useful compilation has been made by Mr. T. Newbigging, late of Bacup, under the title of 'The Gas Manager's Handbook.' It contains an immense amount of information, of a practical character, on all matters which concern gas managers, and forms an admirable work of reference, which will no doubt find a place in every gas office."—*Journal of Gas Lighting.*

"Within the moderate compass of about 160 pages, the author—or perhaps we should more appropriately say the editor of this Handbook has contrived to pack, without crowding—and without confusion or ambiguity, almost all the information which any gas engineer or manager could desire in a book of reference such as this professes to be."—*Colliery Guardian.*

"This volume is an exhaustive cyclopædia of the literature of gas lighting. The author has laid his hands on everything good that already existed, in the way of tables and statistics, and has embodied the whole, with many additions, in the form of a volume, the want of which has been long felt by gas engineers and managers. An interesting chronology of gas lighting is appended to the book."—*English Mechanic.*

"Considering the important position which the manufacture of gas has occupied for some years past amongst the industries of this and other civilized countries, we can only wonder that an earlier attempt has not been made to supply to gas engineers and managers a handbook such as that now before us. That there has been a want of such a work can scarcely be doubted, and although Mr. Newbigging's book is not free from defects, we feel sure that it will be accepted as a useful companion by those for whose employment it was compiled."—*Engineering.*

"The class of books to which the one we notice belongs is among the most useful that issues from the press; and this one, from the variety and amount of information it contains, may be fairly described as one of the most useful of its class. It is a book which will be thoroughly appreciated by those who until now have had to seek in a dozen volumes for the information here collected into one, and who have had to spend hours in making calculations here done to their hands."—*Mechanics' Magazine.*

"C'est un recueil de toutes les données, de tous les calculs, de toutes les formules, de toutes les recettes dont on peut avoir besoin dans la construction et dans la direction de l'exploitation d'une usine à gaz. Rendement des charbons, conduites des fours, épuration, vérification de la qualité du gaz, montage des appareils, ciments, pose des conduites, service d'éclairage public et particulier, travail intérieur d'usine, surveillance, comptabilité, tout s'y trouve, jusqu'à une table chronologique des faits de l'histoire de l'éclairage au gaz; en un mot, l'auteur n'a rien oublié de ce qui peut rendre son livre utile, indispensable, curieux. Nous engageons ceux de nos lecteurs auxquels la langue anglaise est familière à acquérir cet ouvrage; ils y trouveront des indications précieuses."—*Le Gaz*, May 15, 1870.

WILLIAM B. KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

TO GAS COMPANIES.

Just Published,

THE METER LIFE BOOK;

OR REGISTER AND STOCK-BOOK COMBINED.

A clear, concise, and easy method of keeping a Register or History of any number of Meters.

By ROBERT PEAKE KEYS, ACCOUNTANT and GENERAL AGENT,

26, BUDGE ROW, CANNON STREET,

OVER THE KENT FIRE OFFICES.

(Late of the Firm of Hight & Keys, Accountants & Auditors.)

Specimen Sheets forwarded on receipt of 3s. 6d.

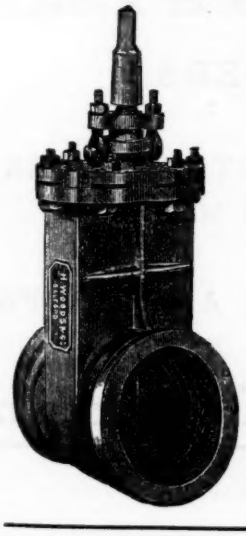
HAMILTON WOODS AND CO.,

LIVER FOUNDRY, SALFORD,

MANUFACTURERS OF

SLUICE-VALVES & HYDRANTS,

As supplied to Water-Works and Local Boards.



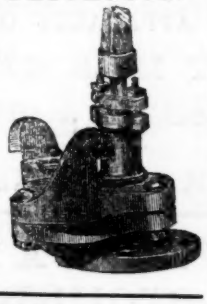
SLUICE-VALVES, from 14s. per inch,

Tight on both Faces, and fitted with Gun-Metal Valve Faces and Seats, and Screws and Nuts.

Every Valve proved to 200 lbs. per square inch.

PRICE LISTS ON APPLICATION.

HYDRANTS,
WITH
Gun-Metal Screws,
Valves, and Nuts,
18s. each.



BALL
HYDRANTS,
84s. per doz.

CALLEY'S

Genuine

TORBAY AND CHEMICAL PAINTS

Are Durable, Economical, and keep their Colours.

Awarded Honourable Mention at the Dublin Exhibition, 1865, and Prize Medal at the Paris Exposition, 1867.

See "The Record of Engineering," 1864; "The Journal of the Society of Arts," June 1, 1866; "The Mechanics' Magazine," Oct. 26, 1866; "The Engineer," Nov. 2, 1866.

WORKS: NEW ROAD, BRIXHAM, TORBAY, DEVON.

HARRIS AND PEARSON,

STOURBRIDGE.

PROPRIETORS OF

BEST GLASS-HOUSE POT & CRUCIBLE CLAY.

MANUFACTURERS OF

FIRE-BRICKS, GAS-RETORTS, AND FIRE-CLAY GOODS

OF EVERY DESCRIPTION.

Orders of any magnitude, for home and exportation executed with all possible despatch.

N.B.—A quantity of Retorts in stock.

Circulars, 15 in. and 16 in. Ovals, 20 in. by 14 in.

D's, 15×13, 16×12, 18×14, 20×16, 21×14, 24×14.

ALFRED PENNY, Gas and Consulting ENGINEER,

WENLOCK IRON-WORKS,

21, WHARF ROAD, CITY ROAD, LONDON.

Mr. PENNY having had a large experience in the construction, alteration, and management of Gas-Works, begs to inform the Directors of Gas Companies that he may be consulted on all matters appertaining thereto. He also manufactures Gasholders, Purifiers, and all the various apparatus used in Gas-Works, and keeps in stock Retorts and Mouthpieces, Socket-Pipes, Bends, Branches, and T-pieces, &c., &c.

Plans, Specifications, and Estimates prepared.

D. GRANT & CO.,

GAS-METER MANUFACTURERS.

STATION-METERS ANY SIZE,

PHOTOMETERS, EXPERIMENTAL METERS, &c.

GAS-METER WORKS, CROSSCAUSEWAY, EDINBURGH.

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

EDGE'S Patent for Removing the CARBONACEOUS INCRUSTATION from GAS-RETORTS.

For particulars and terms, apply to E. GODDARD, Sole Agent, Gas-Works, IPSWICH.

CATHELS'S Patent Ribbed Gas Main-PIPES cost but about 1d. to 2d. per yard (depending on the size) more than Plain Pipes, and ensure PERFECT GAS-TIGHT CONNEXIONS with the Service-Pipes.

Apply to Messrs. BEGGS & SON, 37, Southampton Street, Strand, LONDON.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

OXIDE OF IRON.—

We are prepared to supply, on moderate terms,

HYDRATED PEROXIDE OF IRON (BOG OCHRE),

Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.

FRANCIS RITCHIE & SONS,

BELFAST.

ADDISON POTTER,

WILLINGTON QUAY,

NEAR NEWCASTLE-UPON-TYNE,

Manufacturer of Clay Retorts, Fire-Bricks, and every description of Fire-Clay Goods.

TROTTER, HAINES, & CORBETT,

BRETTELL'S ESTATE

FIRE CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS TILES, and every description of FIRE-BRICK.

Proprietors of

BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.

Successors to

E. BAKER AND CO., LATE BRIERLEY HILL, STAFFORDSHIRE.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 20 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including Iron Retorts, Socket and Flange Pipes, Bends, Branches, and Syphons of all sizes, Lamp Columns, &c., &c.

N.B.—Orders for Cast-Iron Tanks, Girders, Columns, Cylinders, and all irregular castings, will have immediate attention.

CHARLES HORSLEY, Agent.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

Analyses by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

Description.	Cubic Feet of Gas per Ton of Coals.	Illuminating Power in Candles.	Coke per Ton of Coal used. Cwt.	Ash in Coke per Cent.	Sulphur in Coal per Cent.
Best Silkstone . .	10,900	17·0	12·8	2·6	1·7
Norfolk Silkstone . .	11,000	15·94	12·5	4·4	1·64
Silkstone Brights . .	11,500	14·5	12·6	7·4	1·85
Silkstone Nuts . .	10,800	15·85	12·66	6·0	0·69

NOTE.—The illuminating power of the Gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

OFFICES, 34, LONDON WALL, CITY, E.C.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER,

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS,

And all kinds of Experimental Gas Apparatus.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM,

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

CAST AND WROUGHT IRON GIRDERS, BRIDGES, AND ROOFS,

STEAM-ENGINE BOILERS, & GENERAL WROUGHT-IRON WORK.

London Agents: PORTER and LANE, 172, FENCHURCH STREET, E.C.

JOHN HALL & CO.,

STOURBRIDGE,

MANUFACTURERS of FIRE-BRICKS, LUMPS, & TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

TANGYE BROTHERS & HOLMAN,

ENGINEERS, MACHINERY AGENTS, AND MANUFACTURERS.

10, LAURENCE POUNTNEY LANE, LONDON, E.C.;

And BIRMINGHAM (TANGYE BROTHERS), CORNWALL WORKS, SOHO.

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS.

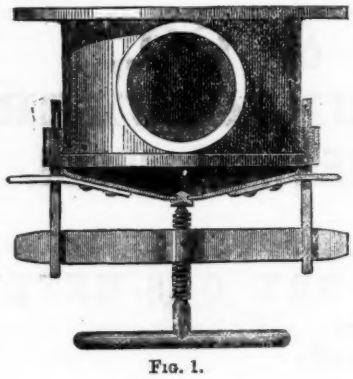


FIG. 1.

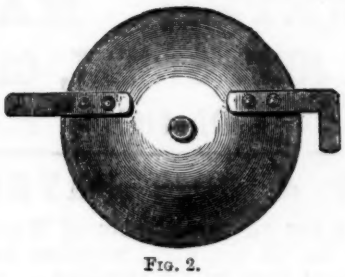


FIG. 2.

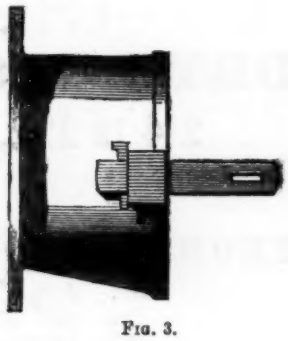


FIG. 3.

Several Hundreds in successful operation in various Gas-Works.

The expensive and cumbersome process of sealing the mouths of Gas-Retorts by means of luting the Lids with lime and other materials hitherto used for that purpose, is henceforth rendered unnecessary, and will be superseded by the very efficient method shown in the accompanying illustrations.

Fig. 1 shows a plan of a mouthpiece with Morton's Patent Lid in section. The mouthpiece is faced true, and the projecting circular edge or periphery of the lid is also turned true, and, by preference, of a semicircular section, so that the point of contact is reduced to a minimum; the convex form of the Lid rigidly sustains the force of the screw, which, by its central action, gives the Lid a uniform bearing, and effectually seals the mouth of the Retort.

Fig. 2 shows a front view of Morton's Patent Lid, which is stamped out of plate iron, having (in this case) ledges to rest on the lugs of the mouthpiece; these Lids, however, are more generally fitted to hinged cross-bars, by which means they remain suspended while the charge is withdrawn and the Retort charged, so that the damage done by throwing them about is entirely prevented.

The advantages obtained are—

1st. The sound sealing of the Retort during the whole time it is carbonizing the charge of coal, there being no jointing medium between the Lid and the mouthpiece.
2nd. The improved condition of the coke by the non-mixture of lime.
3rd. The Lid requires no preparation on the part of the stoker, beyond slightly scraping the surface to remove extraneous grit or dirt.
4th. The Lids are only about two-thirds the weight of the old form in general use, a Lid for a 16-inch mouthpiece weighing a little over 20 lbs.
5th. The Self-sealing Lid reduces labour, saves wear and tear, obviates all the inconvenience and discomfort consequent on the preparation of luting, and effects a great reduction in the working expenses. The cost attending the process of "luting" in several large gas-works, exceeds £1000 per annum, ranging in various works from 20s. to 35s. per mouthpiece.

It will be obvious that a round Lid is the most convenient and the cheapest form. D Retorts are adapted for round Lids, by carrying the bottoms down the necessary depth for that purpose, as shown in Fig 3. Some mouthpieces have been thus adapted, and are in use at the Chartered Gas-Works.

The following testimony speaks in favourable terms after ample and careful test:—

Burslem and Tunstall Gas Company, Longport, Staffordshire, Oct. 12, 1869.

Dear Sir,—In reply to your favour of the 9th inst., I have pleasure in stating that my admiration for your Patent Retort-Lid is most unqualified. I have 14 of them in use, and have tested them in the severest manner possible at these works, but without being able to detect the slightest defect. Yesterday the strap slipped off the exhauster, and a pressure of 13 inches was thus almost instantly thrown upon the Retorts, but although many of the luted Lids were leaking, not the slightest escape was observable from yours. I had anticipated that at least some greater degree of care would have been required in the scraping of the mouthpieces after the drawing of each charge, but even in this particular I find that labour has been reduced.

By every stoker on these works, as well as by myself, your Lids are regarded as a boon.

Please send me 30 more at your earliest convenience.

I am, &c., (Signed) HENRY WOODALL.

R. Morton, Esq.

Chartered Gas Company, Horseferry Road, Westminster, Sept. 15, 1869.

Dear Sir,—I have only lately returned to town, which is the reason I have not replied earlier to your inquiry.

I beg to say that I have had your Lids in use for upwards of two months, and during that time they have always kept a perfectly sound joint. I may add that where your lids are used only one set is required.

I remain, &c., (Signed) G. O. TREWBY.

R. Morton, Esq.

Chartered Gas Company, 146, Goswell Street, E.C., Oct. 20, 1869.

Dear Sir,—I have much pleasure in stating that, after some months trial of your Retort-Lids, I find them everything I could desire. I consider the plan a great improvement.

I am, dear sir, yours truly, (Signed) A. UPWARD.

R. Morton, Esq., London Gas Company.

These Lids are in successful use at the London Gas-Works, the Chartered Gas-Works, the Dublin Gas-Works, the Burslem and other Works, giving great satisfaction.

Application for Licences and other Information to be made to

TANGYE BROS. & HOLMAN, 10, Laurence Pountney Lane, London, E.C.

Sole Makers of Upward's Patent Safety Drilling Apparatus, Weston's Patent Differential Pulley Blocks the "Special Steam-Pump," the Patent Duplex Lever Punch, &c.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF

PATENT WET & DRY METERS,

STATION-METERS AND GOVERNORS,

PRESSURE REGISTERS, GAUGES,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c., &c.

WATER METERS.

W. P. & Co. beg to state that they are now prepared to supply Station-Meters with planed joints.

CONTENTS.

	PAGE
Notes upon Passing Events:—	
The Firearm Question	709
The Asphalte Pavement in Cheapside	710
The Evidence before the Select Committee on Pawnbroking	710
The Newspaper Press in England and her Colonies and in Europe	710
Chinese Fishermen in Australia	711
The Japanese Blue-Book	711
Circular to Gas Companies:—	
Public Lighting in Canterbury	712
Conviction of a Gas Company for Fouling the Water in a Well	712
Still and Lane's System of Making Gas from Small Coal and Tar	712
The Law affecting the Right to Remove Gas-Meters from the Premises of Consumers	712
Suspension of the Supply of Gas in Besieged Cities	712
Correspondence:—	
Exhauster Governors	712
Parliamentary Intelligence:—	
House of Lords Committee—Blackburn Corporation Improvement Bill	713
Legal Intelligence:—	
Conviction of the Canterbury Gas Company for Fouling Water-Wells	715
Miscellaneous News:—	
Bradford Town Council	716
North British Association of Gas Managers	717
Metropolitan Board of Works	719
Meeting of the Cork Gas Consumers Company	721
An Unprofitable Gas Speculation	722
Niotheroy (Brazil) Gas Company	722
Rugby Gas-Works	722
Professor Aikin's Report on Gas-Burners	722
Register of New Patents:—	
Way, J. T.—Manufacture of Manure and Purification of Gas	723
Davies, I.—Rotary Gas-Exhausters	723
Mills, B. J. B.—Meters for Liquids and Gases	723
Lake, W. R.—Chimneys of Gas-Burners	723
Woodhouse, S. J.—Regulating Supply of Gas	723
Newton, W. E.—Centrifugal Pumps	724
Lake, W. R.—Charging Gas-Retorts	724
Bonneville, H. A.—Charging and Discharging Gas-Retorts	724
Gilchrist, A.—Slide-Valves	724
Braby, F.—Manufacture of Caustic Ammonia	724
Applications for Letters Patent	725
Grants of Provisional Protection	725
Notices to Proceed	725
Gas Share List	725
Price Current	726

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

A Subscriber.—42, *Clifton Road East, St. John's Wood, London.*

NOTICES.

The subscription to the Journal is 15s. per annum, if paid in advance during the month of January, or 18s. credit, in two sums of 9s. each, in July and January of each year. Post-Office orders should be made payable at the Money-Order Office, London, to William B. King, 11, Bolt Court, Fleet Street, by whom the business department of the Journal is conducted.

SCALE OF CHARGES FOR ADVERTISEMENTS.

Six lines and under . . . . . 3s. 0d.

Sixpence per line for every line additional.

Special contract for advertisements intended for continuous insertion.

This Journal has been duly registered at the General Post-Office for transmission abroad.

The next number will be published on Tuesday, October 11, and the subsequent numbers on each successive alternate Tuesday.

All communications for the Editor to be addressed, "No. 42, Parliament Street, Westminster;" and all remittances for subscriptions or orders for advertisements to the Publisher, No. 11, Bolt Court, Fleet Street.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, SEPTEMBER 27, 1870.

Notes upon Passing Events.

The question of firearms, small and great, which has been simmering amongst professional men and a few amateurs for nearly twenty years, is beginning to be discussed in a manner which shows that public opinion will soon compel our military authorities to make another stride in advance. The introduction of the Enfield, and the change to the Snider breech-loader, seem for the present to have exhausted the Horse Guards energies. Sir Joseph Whitworth, in a letter to the *Times* the other day, showed that in dimensions of bore and of missile he long ago, in his first published report, laid down the principles that have been adopted, partly in the needle-gun, more fully and more successfully in the Chassepot, and still more successfully in the Martini-Henry and the Westley Richards, and all small arms of precision. Sir Joseph throws the weight of his high mechanical authority against the breech-loading arrangements of the Martini-Henry, the favoured arm of the amateurs in office—an excellent weapon for quick and accurate shooting at a trial, but not suited for the rough work of a campaign. It is a sign of the times that the merits of breech-loading rifles were discussed at the meeting of the British Association for the Advancement of Science. Amongst those who took part in the discussion was a Mr. William Hope, who served in a light infantry regiment in the Crimea, where he earned the rare distinction of the Victoria Cross. After the Crimean war, Mr. Hope passed some time in the United States as *attaché* to his cousin, Lord Napier. From the United States he brought several specimens of breech-loading and repeating rifles, whose merits are now so well known. He wasted a great deal of time in endeavouring to persuade our Horse Guards to take up the breech-loading principle, and work it out with the aid of our unrivalled mechanics. How deaf and blind our military authorities were until converted ten years later by the Prussian victory at Sadowa is now an old story. But this introduction is of importance, because it shows that Mr. Hope was an authority in the discussion in which he took part at Liverpool on Mr. Marshall's paper comparing the official Martini-Henry and the private enterprise—Westley Richards:—

Mr. Hope said there were two serious objections to the Martini-Henry rifle, and one or two great advantages in the Westley Richards. The position of the opening lever in the Martini was altogether misplaced. It closed around the small of the stock, the very part which a soldier required to grasp. As the British recruit was inevitably a clumsy fellow, he would crush his fingers in endeavouring to open and shut it. There was great advantage in the minor arrangements of the Westley Richards rifle, inasmuch as the soldier would always have a piece of wood to grasp; while in the Martini-Henry his hands were exposed to an iron surface. In the Crimea, in cold weather, he had seen the flesh of a man's hand adhere to the barrel.

Sir Joseph Whitworth said he had had diagrams prepared for the purpose of illustrating the Chassepot, the Prussian, the Enfield, and the Whitworth bullets. The Chassepot was 2·44 calibres; the Prussian, 2·01; the Enfield, 1·93; and the Whitworth, 3·00. At an elevation of 58 minutes, the range of the Chassepot was 500 yards; the Prussian, 206 yards; the Enfield, 295 yards; and the Whitworth, 345 yards. The range of the Chassepot and the Whitworth was the same at 1500 yards. The two most important elements in the long range were a full charge of powder, and sufficient length of bullet. In both these respects the Enfield ammunition was sadly deficient, and he had been urging the War Office authorities ever since 1857 to substitute the ·45-inch bore. The velocity of the Chassepot bullet was much greater at the commencement of its flight, much less at the end; thus, its penetration was comparatively small at long ranges. The lighter weight and want of velocity at the end of the range tend to lessen the penetration, and a short bullet was comparatively useless for peneration at long ranges. He might mention that the shooting of the small-bore was so superior to that of the large-bore Enfield that they had never cared at Wimbledon to shoot with the Enfield at a longer range that 600 yards. In spite of this he was sorry to say that the Enfield had been made, and was being made, in innumerable quantities.

Mr. E. J. Reed (late Chief Constructor of the Navy) said he did not think the subject before the conference required discussion. It appeared to be universally admitted that the small-bore rifle was a long-range weapon, and that if troops were armed with a large-bore or short-range rifle they would be subjected to a murderous and destructive fire before their rifles were brought within range of an enemy armed with the small-bores. It was clear that the small-bore or long-range rifle was the only effective weapon for military warfare to make that warfare effective, and there must be some mysterious reason, which he was unable to discover, if the British soldiers were to be deprived of the superior weapon.

Mr. Stewart said he had found the spiral spring in the Martini rifle to be very liable to dust and rust, which prevented it from fulfilling the purposes for which it was intended. He had also found that the lever was placed in such a position as to prevent bayonet exercise from being satisfactorily gone through. In regard to these points the Westley Richards rifle was very superior to the Martini, though the lever of the former was rather in the way.

Mr. F. J. Bramwell said there were mechanical merits in the Westley Richards rifle which the Martini did not possess, and he trusted that before the nation was committed to an expenditure upon an imperfect weapon, the suggestion for a further investigation would be accepted.

The Chairman remarked that a bullet which would carry the longest distance must be the best missile to place in the hands of the soldiers, and he thought the object of the Government ought to be to combine all the best points in one weapon.

We have given this extract from the proceedings of the association for promoting science in order to suggest that this is just one of the subjects that the Institution of Civil Engineers ought to take up for discussion. Surely the numerous Colonels on its council ought to have some interest in rifles; but if reporters are to be tabooed, and reports to be filed and polished down to one uniform style, only to see light some months after active proceedings have occurred, the discussion, for all practical purposes, might just as well take place over the mahogany of one of the hospitable vice-presidents. Mr. William Hope also read part of a paper on "The History of the Shell that Won the Battle of Sedan," in which he stated that in 1856 he submitted a shell to the chairman of the Ordnance Committee, "who told him that, as it required a rifled gun, it could not be even taken into consideration, because rifled guns would never be introduced into the British service." He next tried Colonel Boxer, who accepted the shell, and shortly afterwards—*more suo*—patented a shell which was the same in all essential particulars—a propensity of Colonel Boxer's we have before alluded to as the impression of the Woolwich subordinates. Here Mr. Hope, growing controversial, was stopped by the chairman of the section; but, considering Mr. Hope's pugnacity and pertinacity, we dare say his shell will burst in some other place. It may be as well to remember that General Sir Charles Napier, one of our greatest modern generals, was very much opposed to any kind of rifle or long-range arm of precision.

Great progress has been made in laying down the Val de Travers pavement in Cheapside. The Poultry part is completed. Nothing can look cleaner, neater, or more likely to diminish noise, discourage dust, and reduce scavenging to the simple operation of collecting dung and sweeping with a broom after washing with a hydrant. Nay, under ordinary circumstances, washing with a head of water might be sufficient. But we are afraid it will be found terribly dangerous for horse traffic; at present it seems nearly as slippery as rough ice. The omnibus conductors who travel over the small specimen in Holborn report it as most dangerous when quite dry or very wet, and that it inflicts on the horses, who fall and slide along, more wounds than any pavement. How far the danger of the Holborn bit may be due to clay brought from the granite pavement, we cannot say; at any rate, it is certain that asphalte will require special attention from the dung-collecting boys and the scavengers. It seems a proper subject for those india-rubber besoms that once used to be plied so industriously by volunteer scavengers.

A Blue-Book of evidence taken before a select committee on pawnbroking has lately been issued. After reading it, one wonders that any one voluntarily takes up a trade so unpopular, so troublesome, and, if we are to believe the evidence of pawnbrokers, so unprofitable. It is a very great misfortune for any man, with the tastes of a gentleman and no taste for making money, to be born a Jew, subject to the prejudices of all countries and all classes of society; but people *are* born Jews, and cannot avoid the insults of the vulgar and the slights of the educated classes—see Mr. Attenborough's evidence. But, if pawnbrokers only make 10 per cent. on their capital by lending it out in 10s. loans, we ask, why are they pawnbrokers? It seems that there are 425 pawnbrokers in London, with no tendency to increase. The pledges of a large number do not average more than 5s. each; 95 per cent. are redeemed; on those left only two days, and those not redeemed, they make a positive loss, which is only reduced by opening a trade in selling unredeemed pledges of the value of less than £10. The cheapest thing pledged is a flat iron, value 4d.; while Mr. Attenborough, of Piccadilly, is willing to advance £2000 or more on diamonds. It is the ordinary practice of working people in Manchester and Glasgow to pledge their best clothes on Monday and take them out every Saturday. The rich pawnbrokers would with pleasure limit the lowest advance to 2s. 6d., and forbid clothes to be pledged at all. The pawnbrokers whose principal trade is in pledges under forty shillings and under twenty shillings take quite a different view of the case. According to the evidence, there are thousands of persons engaged in the trade of cheating pawnbrokers by pledging "*duffing*" goods in clothes, plate, jewellery, &c. After pledging, they endeavour to sell the tickets. The whole tenor of the evidence goes to show that the pawnbroker is the poor man's banker. The pawnbroker likes a regular customer—one who comes to him for ready money for trade or on emergencies. The man who comes to raise money by pledging, with no intention of redeeming, is not considered a desirable person. We have a picture—the shoemaker who pledges a pair of new shoes, buys leather with the money to make two pair more, and then redeems and sells the lot! The evidence warns charitable people, or people fond of bargains, not to purchase pawn-tickets, with any hope of even seeing their money back. Pawnbrokers must know a little of the value of everything, from a flat iron to a diamond ring. Pawnbrokers do not see the bright side of human nature. One says: "I am on the debateable "ground between what we call rich and poor. My customers are "of two classes—the operatives and those who have quarterly "salaries. I find there is always an idea to ape the manners, habits, "and customs of those above them. If a man gets £1 a week, "he wants to dress like one with £2; if a man in a warehouse is "getting £100 a year, he must dress and live like one with £300. "This leads to pawnbroking and mortgaging." This is at Manchester and Salford. Mr. Robert Attenborough, who deals in Piccadilly with the highest classes of pawners, objects very much to any regulation of his trade, except a minimum on the amount to be lent. He objects to recording transactions any more than bankers, and thinks bankers receive quite as many stolen bills and fraudulent bills as pawnbrokers receive stolen goods. "My "bankers," he says, "are Messrs. Herries and Farquhar, as "respectable a house as any in London, and I should think they "get as many transactions that they would rather not have "entered into as I do." Messrs. Herries and Farquhar did not give evidence. We may return to this volume for the evidence of magistrates and police, who do not take quite the same view as the pawnbrokers, who, if we are to believe them, are philanthropists, working for bare profits. Still, it must be admitted that, according to all evidence, pawnbroking, properly regulated, is an important assistance to the industrious poor.

French and German newspapers are often written by very clever men. Their leaders on important subjects cannot be excelled; but it is only amongst the English-speaking race that a weekly or daily journal of the news, worthy of the name, can be. The comparison between the little dirty rags that are issued as newspapers in the provincial towns of France and those of Manchester, Liverpool, Leeds, Birmingham, and Southampton, is even more remarkable than between the journals of London, Paris, and Berlin. The same superiority in type, paper, and variety of news, is to be found in our Australian colonies. In France and Germany nothing is to be found equal to the non-political newspapers devoted to manufactures, agriculture, horticulture, and field sports in Melbourne and in Sydney. We have now before us a copy of the Sydney *Town and Country Journal*, a very good imitation of the English *Field, or Country Gentleman* newspaper. It is the same size, and contains thirty-two pages profusely illustrated with woodcuts. Amongst the local advertisements we note sugar machinery, one of the new industries of New South Wales; sheep-washing machinery, which seems to be erected on a very elaborate and expensive scale, for washing thousands of sheep with warm water; and the advertisements of a meat-preserving company. Agricultural societies and horse-racing seem both more warmly supported by the public than in any continental state of Europe. A waxwork exhibition announces the addition of a figure of Thunderbolt—a racehorse, we believe—Lord Clyde, and Mr. Peabody, the great philanthropist. Amongst the illustrations, which are, however, principally devoted to machinery, is a portrait of the King of Prussia, with a memoir. In the following account of a trip round Lake Macquarie, we find that ever spreading Chinese have settled themselves in the oldest Australian colony:—

Between the Pelican Islands and Karignan Creek there are two Chinese fisheries. I arrived at the house of Mr. Ah Tie (the principal boss of the whole concern) late one night, in the middle of a strong gale of wind and a terrific downpour of rain. The reception we met with was hearty and cordial in the extreme; and, notwithstanding that all the fires were extinguished, and the party about to retire to their couches for the night, Mr. Ah Tie, with a degree of courtesy and hospitality rarely evinced by Europeans, insisted upon our having some supper, and, after the lapse of about twenty minutes, we were comfortably seated before a table smoking with boiled whiting, cooked in a style that defies description. Never in my life before had I tasted fish cooked like that was; and I very much question if I ever shall again until I pay another visit to the lake. From the lips of Ah Tie I learnt that altogether there are about seventeen Chinamen engaged in the work of catching and curing fish on the lake. Of this number nine are under the leadership of Mr. Ah Tie, while the remaining eight acknowledge as their chief a highly intelligent-looking individual rejoicing in the name of Hop Lung. The respective parties of Messrs. Ah Tie and Hop Lung live about half a mile apart, and appeared to be on the most friendly terms. They have each two or three very comfortable slab cottages, well lined and shingled, and perfectly weather-tight, which is more than can be said of all the European dwelling-houses on the lake. Between the cottages where they live and the water's edge (a distance of about 200 yards) there are several sheds and huts, in which one or other of the operations of fish-curing is performed. Attached to the fisheries are four long-boats of about eighteen feet keel, and any number of nets, the construction of which is rather peculiar, inasmuch as they can be used separately in shallow water, or unitedly in deep water, interlinked together so as to form one immense net. These fisheries were first established about seven years ago, and have been continued with fluctuating success ever since. The average quantity caught and cured per week, is about three quarters of a ton, or between 30 and 40 tons in the year. Some years the quantity has reached 60 or 70 tons, but that was when the number of fishermen was about double what it is at the present time. When cured and packed, the fish is sent to Sydney, Melbourne, and China, and realizes, as a general thing, about £20 per ton. As regards the "taking" of the fish, I could glean very little from the Chinamen themselves, but a great deal from their less successful European rivals; some of whom complain loudly of the unfair and unlawful way which John Chinaman has of "making a haul." The unlawfulness of their procedure is said to consist in the immense nets which they use—nets more than twice the size that the law allows. So far as I observed, during my brief stay at the lake, the Chinamen have no particular times for fishing, but sally out (weather permitting) whenever their supply for curing is exhausted. Several years ago, when the fisheries were in their infancy, a great number of the larger kinds of fish—schnapper particularly—used to be taken with lines and hooks, baited with pieces of fresh fish, &c.; but of late the lake has been too well scoured with nets to admit of line-fishing, excepting for mere amusement. The principal kinds of fish cured by the Chinamen are schnapper, bream, whiting, flat-head, and mullet; but Messrs. Ah Tie and Hop Lung are not at all particular, and it is very rarely that they catch a fish they cannot make use of in one form or another. The smaller varieties—such as perch, tailor, garnet, soles, herrings, &c.—are mostly converted into a kind of semi-liquid preserve, similar in appearance to the preserved tin fish which is imported into this colony from England. The curing of the fish is a tedious and uncertain process, depending for success entirely on the weather, the study of which forms the hourly occupation of the superintendents of the fisheries, Messrs. Ah Tie and Hop Lung. The drying sheds and tables on which the fish is prepared are placed as near the shore as possible, and everything in connexion with them appeared to be scrupulously clean. The boats unload at a pier or landing-stage, extending some distance into the water, and upon which each fish is thrown separately. From hence they are taken in baskets to the splitting-table; and after being there opened, headed, and the backbone removed, they are passed on to another part of the establishment for salting. And herein lies the chief art of curing, as no fish should have more salt upon it than is absolutely necessary to preserve it, and should only remain a certain number of hours or days—according to the kind of fish being salted—in pickle. Sometimes, however, these rules are not strictly adhered to, and the result is the production of those inferior articles that are so frequently seen in the market. After salting, the fish is placed in a large trough filled with water, cleansing away superfluous salt, until at length it is laid on slabs or sheets of bark, to be dried by the sun. The labour spent on this part of the process is very considerable, each fish having to be shifted and turned an immense number of times before it is finally ready for packing and exportation. Happening to look at some books lying on a table in the building used as a bedroom, I was inquisitive enough to ask what kind of book one of them was, and was informed, in reply, that it was the "account-book," into which every consignment of fish was duly and carefully entered. Ah Tie also showed me his "ready-reckoner," which was made of wood instead of paper, and closely resembled the articles used in the public schools to teach the younger children to count. Besides the account-book there were a number of other Chinese books lying about the room, several of which I was given to understand contained songs of a

comic description. The leisure time of the Chinamen appeared to me to be devoted mainly to smoking, card-playing, song-singing, and making cabbage-tree hats; and in the last-named department of the fine arts it is only doing them justice to say they have arrived at the acme of perfection, the very finest of the hats sold in the shops in Sydney being absolutely coarse in comparison with theirs. The price for their best hats is £2 10s. and £3, but they sell a very fair article for about 25s.

The highly coloured pictures of the advantages of emigration for gentlemen of small capital are not endorsed or encouraged by the following incidental account of the unsuccessful efforts of two intelligent gentlemen to find a paying agricultural crop:—

The farm was a selection of 200 acres, and contains about the largest patch of cultivation on the lake. It is almost entirely surrounded by water, and contains some alluvial land of very fair quality. The homestead is very pleasantly situated, and comprises a good substantial weatherboard house, containing five or six rooms, together with detached kitchen, dairy, out-houses, barn, &c. Of the 200 acres of which the farm consists, about 100 have been cleared, and about 50 are under cultivation. Since Messrs. Chapman and Lyster have had this farm, they have tried a variety of things to make it pay, but up to the present time, I regret to add, their labour, which has been very extensive, has not been adequately rewarded. Year after year they have tilled and planted, but all to little purpose, for directly a crop was in the way of turning out profitable, something would transpire to make it a failure. One year it was the rust in the wheat, another the blight in the fruit trees, and a third something else. Among other articles that they have attempted to cultivate may be mentioned the following—namely, wheat, maize, sorghum, millet, potatoes, arrowroot, grapes, the castor-oil plant, and the sugar-cane. The attempt to grow wheat and maize has been a dead failure, though more success has attended the planting of potatoes, arrowroot, millet, and the castor-oil plant. The last-named article, singular to say, appears so far to thrive luxuriantly, and, unless I am much mistaken, will be grown somewhat extensively in the colony before very long. Arrowroot also grows well on Terzeny Park, and, by the aid of a small mill, which they have on the premises, Messrs. Chapman and Lyster have already converted a good deal of it into a first-class marketable article. The figure realized, I think, was about 1s. per pound. Besides the regular business of farming, Messrs. Chapman and Lyster have given their attention to several industries—such, for example, as that of broom-making and the curing of fish. In the former line, Mr. Chapman was the first person who thought of adapting the fibre of the native lily plant to the purposes of broom-making, using it in the room of millet. The experiment has only been a partial success—owing, however, to want of proper appliances to make the brooms rather than to the unsuitableness of the material. By-and-by, I have no doubt, the fibre of the native lily, or gigantic lily, as it is otherwise called, will be very extensively used for this and other purposes. It grows in great abundance between the lake and the colliery township of Minmi, but requires considerable preparation before it is fit for use. The small quantity of sorghum put in by Messrs. Chapman and Lyster has thriven well, and affords ample proof, if any were needed, of what the whole farm is best adapted for—viz., a sugar plantation. From what I saw at Mr. Marshall's place I am confident that both the Bourbon and the Tahitian varieties of sugar-cane would flourish luxuriantly on this farm, and to those having a crushing-mill of their own, or a sure market for the sale of their cane at a reasonable price, the possession of this 200 acres of land would be a sure fortune. Of course, it would require some capital to convert the farm into a sugar plantation. The fruit trees put in by Messrs. Chapman and Lyster some time ago are only doing moderately well, while some grape vines which they planted about the same time have died almost completely away. Oranges, too, only succeed moderately well.

The most novel feature in connexion with this farm is the attempt to rear a flock of goats of a superior breed, with the ultimate object in view of exporting their hair. To this end he has devoted a small island to the exclusive use of the goats, which already number about fifty. It appears that the Government, in order to encourage the breed of a superior class of goats, have offered to supply any person rearing fifty common goats with a ram of the well-known Angora breed, free of expense, the only condition in the transaction being that he should give one of the progeny to any other party in the neighbourhood rearing the specified number of fifty goats of the ordinary kind. It may be an item of interest to many to mention that the hair of the Angora goat is worth in Europe as much as 10s. a fleece. In Tasmania and South Australia a good deal of attention has been paid to this subject, and there are several parties in both those colonies who are already somewhat extensively engaged in the new pursuit. In the meantime, however, Mr. Chapman's goats are no loss to him, as the quantity of milk which they give is very considerable, ranging from a quart to half a bucketful per day, while the feeding of them costs little or nothing.

It is gratifying to find, from reading the Australian newspapers, how much attention is being paid to education. Melbourne contains, perhaps, the finest free library in the world. Books, maps, and engravings are free to any sober man or woman, youth or girl, without any introduction.

Blue-Books are not usually very amusing reading, although our readers must have found out that few publications afford better materials for judicious selection. Among the most extraordinary and interesting that has come under our notice are those relating to Japan, issued to both Houses of Parliament last session. Japan, until within comparatively few years a *terra incognita*, promises to exceed China in interest, and to excel in the capability of political and commercial development even European states. At the last International Exhibition at South Kensington, the Japanese wood and iron work excited admiration by its exquisite fit, as well as taste in colour and design, compared to kindred Chinese models. It is well known you may travel through France and Germany and scarcely find a door, a window, or a chest of drawers that will open and shut properly. We have it from an English cabinet-maker, of very advanced political opinions, that while he saw much to admire in design in Paris, he scarcely met with a workman who would have passed muster as to fit in our best shops. In the same way, English mechanic engineers declare that, with rare exceptions, French machinery, French tools, and French guns are deficient in fit, just as our work is so often deficient in tasteful form and colour. But Japanese cabinet work is all finished with exquisite perfection, a chest of drawers working like an air-pump. Japanese talent in painting, especially in miniature caricature figures, is well known. The use of steamboats—which they repair—of photography, and many other modern scientific utilities, has been rapidly adopted by the Japanese, who, in general intelligence, seem far ahead of the Chinese. But it is when we investigate the political position, and compare the advances they have made with the Turkish Empire or the Kingdom of Greece, that our astonishment becomes unbounded. Buried in Blue-Book No. 3, we find an account of a peaceful revolution, in comparison with which our two Reform Bills are insignificant, and we must go back, to find any like it, to the destruction of feudal power in England which Henry VIII. completed. Up to 1868 the ruler of Japan was a sort of Pope-King or demi-god, living in entire seclusion. In November, 1868, as one of the results of the successful colonization of foreigners, the Mikado, in a magnificent procession, transferred himself from his seclusion at Kioto to the light and life of Yeddo, the capital of the Tycoons. "The troops in the procession were in excellent order, fairly drilled, and well armed, mostly with breech-loaders; *the immediate body-guard of the Mikado had repeating rifles.*" A few days before the Mikado left Yeddo, he embarked on a small steam-yacht to inspect the few Japanese ships then lying in the bay. This was the first time he had been afloat, and the step involved a marked innovation on previous practice, and some disregard to native superstition. A proclamation announced that "His Majesty has visited the eastern capital, and personally "superintended the affairs of government. Although his bounty "is not yet fully extended to the whole people, still the country "is now in the main restored to peace and tranquillity. He "will return to Kioto during the first decade of next month. "His Majesty intends to come to Yeddo again next spring; "all officers of Government will bear this in mind." A still more extraordinary step followed. A sort of Parliament was formed, in which discussions were carried on with a degree of genuineness, dignity, and absence of bombast—in fact, real attention to business—that several continental political assemblies might emulate with advantage. Shortly afterwards 24 of the nobles, holding lands on a sort of feudal tenure, with powers as complete as those of the Electors of Germany under the Emperor before the French Revolution, determined to resign their political powers and revenues into the hands of the Mikado. These revenues, amounting to 24 millions sterling, were surrendered in a memorial which contains the following remarkable passages:—"Since the heavenly ancestors established the founda-"tion of the country, the Imperial line has not failed for "ten thousand ages; heaven and earth (*i. e.*, Japan) are "the Emperor's. There is no man who is not his retainer. This "constitutes the great Body. By conferring rank and property "the Emperor governs his people—it is his to give and his to "take away; of our own selves we cannot hold a foot of land; "this constitutes the great Strength. In ancient times the Em-"peror governed the sea-girt land, and, trusting to the great Body "and the great Strength, truth and propriety being upheld, there "was prosperity under heaven. In the Middle Ages the ropes of "the net were relaxed, and half the world tried to appropriate the "people and steal the land. Traitors encouraged one another "until the strong preyed upon and devoured the weak. The chief "traitors annexed province upon province, while the less main-"tained several thousand retainers." A number of documents in the same tone follow. The paper resigning the feudal fiefs is headed by the Prince Satsuma, who some years ago defended himself against the attacks of a British, French, and Dutch fleet. The promoters of the revolution, in their new oath to the Mikado, when he was called upon to resume the powers of government, asked for a national council—viz., that "the practice of dis-"cussion and debate shall be universally adopted, and all "measures shall be decided by public argument." Under this arrangement a chamber of two hundred deputies was formed. One paper defined the rules of debate; the other provided for the division of the house into committees, and named special subjects to be deliberated on. Altogether the Government of the Mikado appeared to be in advance of his European prototype, the Pope, so lately dethroned. The president of the Parliament, in issuing a list of the subjects to be discussed, requested that "every member will choose one of "these subjects, to the thorough discussion of which he "will diligently apply himself." Amongst these subjects are agriculture, taxes and duties, roads, mines, foreign trade, redeeming waste land, public instruction, army and navy. When we know that Japan has great wealth in minerals only surface worked, we may anticipate great results from the discussion. Already the debate on roads has produced a railway scheme. Among the papers under notice, all interesting, not the least curious is a protest against the introduction of Christianity, by a naval officer, a Buddhist. Buddhism is not the religion of the State, but freely tolerated, and even allowed a place on certain occasions of State ceremony. Changing the words, this paper might have been written by a Spanish Ultramontanist or an Irish Orangeman:—

The Western doctrines of the religion of Jesus have of late been promulgated to an alarming extent. Foreign priests have erected churches, and led away our people from the right path. Common people are now professing the religion of Jesus to the number of 3000. The foreign religion teaches that all those who believe and follow it will be happy; that those who are poor will become rich; that those who are ignorant will be made clever; that low people will be raised, and the sick will recover health; and, accordingly, that every man's happiness and change to a better condition depend on his own will and faith. No wonder that people who have once set their hearts on this religion, and believe it firmly, care not for life or death. Their whole mind is concentrated upon one thing; they adore it incessantly in their prayers and thanksgivings. In addition, foreign priests residing at these places have employed gold and silver as means of persuasion; they have by these means seduced our poor people, who only follow their evil passions, and have converted them into instruments for deluding other victims. Does the consideration of these facts not give rise to serious apprehensions? They preach that Jesus was crucified of his own free will, and died for the atonement of the sins of all men. His followers are therefore naturally indifferent to life, and look upon dying for their faith as glory to themselves. If we examine the fundamental principles of the religion of Jesus, we are struck by discovering that it is based entirely upon deceit, immorality, and imposition. In some respects its precepts resemble our Buddhistic doctrines. Thus they contain a doctrine of retribution in this world and in a future one, a divine guide to happiness, together with threats of hell and damnation for the wicked. . . . Unfortunately we know from experience that our clergy have nearly all become pleasure-seekers, idle, and useless beings addicted to chess-playing, reading poetry, tea-drinking, making bouquets, and given to the vices of wine and women. . . . During 2000 years Buddhism has been the main support of the Mikado's Government; it is so still at the present day. See here the great merit of Buddhism. It is the religion of the country. Let us not look on it as a foreign religion. Where, therefore, foreign religion is allowed to increase, as the religion of Jesus is now doing, Buddhism is thrown into great danger. Every one who opposes Buddha and assists the religion of Jesus is the enemy of Buddha—that is, the enemy of his country: let him be exterminated.

These words might have been preached to Louis XIV. before he ravaged the Palatinate, or before the Irish Parliament when it passed its bloody penal laws under the influence of Huguenots trained by King Louis.

Circular to Gas Companies.

The Corporation of Canterbury are complaining of the quantity of gas consumed in the public lamps. In this city—and we believe it is the only instance in the kingdom—a meter has been attached to every lamp. It is alleged that this was the result of a misunderstanding. The Corporation, while intending to adopt the average meter system, gave instructions to the company to put meters to all lamps. Complaints are now made of great irregularities in the quantity of gas consumed in the lamps, and many of the council are in favour of doing away with the meters, and returning to the contract system. A resolution confirming the minutes which recommended the abolition of the meters, however, was lost at a recent meeting of the Town Council, and a deputation has been appointed to confer with the gas company. With regard to the irregularities which have caused the dispute, it seems likely that they may arise either from the absence of or the use of defective regulators; for one of the Town Council remarked that the consumption was greatest in the highest parts of the town. This is a state of things that can easily be rectified, and there can be no reason why perfect harmony should not subsist between the company and the Corporation. We would recommend the officers of both to pay a visit to Folkestone, or some other town where the average meter system is in operation under efficient supervision, and they will find that it can be worked with the utmost satisfaction to all parties.

A report, which we publish in another place, shows the Canterbury Gas Company in other troubles. An inhabitant of the town has obtained a summary conviction against them, for fouling the water in his well. According to the opening statement of the complainant's counsel, there is a section in the company's Act, by which it is enacted that, whenever any water within the limits of the gas company was made foul by gas or washings from gas supplied by the company, they should, after 24 hours notice, remedy the nuisance, and, failing that, pay a penalty of £20 for the offence, and 10s. for each day it was continued after the notice was given. It was admitted by the company's officers that a gasholder-tank had leaked from 1851 to 1868; and, in this way, a state of things had been induced which clearly made it impossible for the company to comply with the strict requirements of an Act of Parliament drawn without thought. When the soil is saturated by leakage from a gasholder, it is impossible to say for what length of time a shallow well, like that of the complainant in this case, may not be fouled by gas products after the leak has been effectually stopped. It appears that, since 1854, when the effects of the leak were first observed, the complainant has been supplied with water gratuitously from the old mains of the company (gas and water being in the same hands); and a notice that this supply would be discontinued, has brought about the present proceedings. It is to be regretted that the company did not take some trouble to ascertain that the effects of the leak had ceased, before they gave notice that the gratuitous supply of water would be discontinued, since that might have spared them the cost and obloquy of this prosecution. As, however, notice of appeal has been given, the case must still be regarded as *sub judice*, and we forbear further comment; but we may venture the remark that, if the conviction be affirmed, this and the four similar cases involved in the decision will swallow up a large portion of the company's profits, and suggest that gas companies cannot observe too much caution in preventing leakage, and the consequent pollution of water in adjacent wells.

The report of the meeting of the Cork Gas Consumers Company, which will be found in another place, is of much interest to gas producers, since it shows the practical results of the working of Still and Lane's patent for the improvement of gas by the use in retorts of powdered coal incorporated with coal tar. In the absence of particular information as to the quality of the bulk of the coal employed, and taken in conjunction with the profit made, the maintenance of a supply of 16-candle gas must be regarded as a highly favourable result. The question as to the economy of the use of tar in this way, when a ready sale for it can be obtained, is still an open one, upon which information is very desirable. Some highly interesting communications on the use of tar and the residue of paraffin oil purification in the production of gas, were given in our last number, in connexion with which we are desired to state that an error of some importance occurs in our report of Mr. Hislop's remarks, p. 690. He is made to say that he obtained an increased result from the use of 30 gallons of coal tar to one ton of coal, over coal by itself, of 42 *per cent.* Mr. Hislop's actual figures were 32 per cent. for coal tar, and 50 per cent. from the paraffin oil residue. Before the next meeting of the North British Association of Gas Managers, it is to be hoped that the subject of the economic use of these substances will be more fully worked out. At present the disadvantage of the paraffin oil residue appears to be that the products are not permanent gases, but easily condensable vapours; and the gas loses a large per centage of illuminating power on standing. This difficulty, we have no doubt, will be surmounted; but it is not to be expected that the permanent gas and vapour will have so high an illuminating power.

A correspondent asks our opinion on the following case:—A consumer supplied with gas by a company without statutory powers becomes bankrupt, and as no guarantee can be obtained for the payment for the gas consumed after the bankruptcy, the manager of the gas company enters the premises, and—notwithstanding the protestations of the bankrupt and the person in charge of the business—takes away the meter. The manager is now threatened with an action for trespass, and the question is, had he any legal authority to act in the way he has acted? The question is fully answered in the case of *Dicks v. The Equitable Gas Company*, reported in the Journal of Gas Lighting, vol. ix., p. 753. The decision in this case was that no gas company had a legal right to enter upon premises without the consent of the owner or occupier, for the purpose of removing a meter, unless the Gas-Works Clauses Act, 1847, was incorporated in the special Act of a company. All others must pursue the ordinary course of cutting off the supply externally, and bringing an action in the county court for the unlawful detention of the meter. The Gas and Water Facilities Act, wherever it is applied, will in no respect help gas companies to recover their property.

We are officially informed that the supply of gas in Strasburg was not suspended on account of any deficiency of coal, but by order of the mayor of the city on the second day of the bombardment (Aug. 16), as a measure of public safety. The papers inform us that a similar determination has been come to in Paris, and that the gas will be cut off when the first shell is fired. In the meantime a provisional contract has been made for lighting Paris with petroleum, should it be found necessary to discontinue the supply of gas.

The report on gas burners by Professor Aikin, of Baltimore, which we publish in another place, is unfortunately not so valuable as it might have been to English readers, in consequence of the absence of a sufficient description of the burners in respect of dimensions, sizes of holes, &c. Some of the burners seem to give highly satisfactory results, but the experiments are not very conclusive as to their merits.

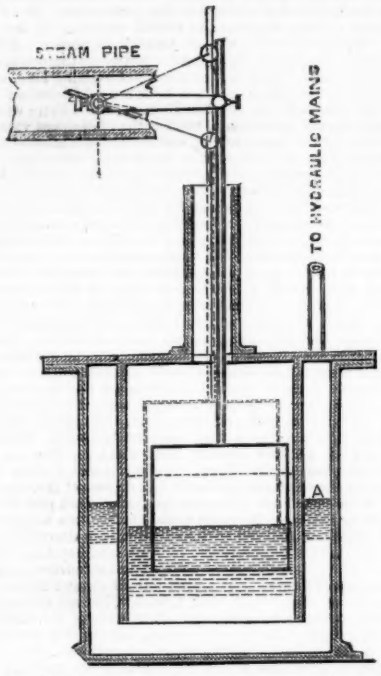
Correspondence.

EXHAUSTER GOVERNORS.

Sir,—Would any of your numerous readers be so kind as to inform me how I might convert the governor, or regulator, shown on this sketch, into a self-acting machine, which shall take the gas from the hydraulic mains *at a uniform pressure or vacuum*—which pressure or vacuum shall not be affected by any *ordinary* variation in the make, or the pressure of the steam in the boiler?

The defect I desire to remedy is this. Suppose I required to work 1-inch vacuum on the hydraulic mains—an increase in the make would throw a pressure on the surface of the water in the outer annular space, A, depressing its surface, and raising the water-level in the interior float-chamber. The displacement of the float being nearly constant (the length of leverage in the several possible posi-

tions being nearly the same), it would rise, and open the steam throttle-valve, driving the engine and exhauster faster; but, as the outer and inner levels in these two chambers would correspond with the vacuum on the hydraulic mains, there would be a *pressure* on the hydraulic mains, or *less* vacuum than was desired.



For example, let there be such an increase in the make of gas as would require the steam throttle-valve to change its angle from the position shown to nearly full open; the lever would also rise, and with it the float, to the dotted position drawn. But, that this be possible, the water must rise in the interior and fall in the exterior chamber, which necessitates a change in the position of the lever relatively to the float-spindle, if I continue to work the same vacuum.

It will be evident that the objection here stated has four cases—namely, an increase or decrease in the steam pressure, and an increase or decrease in the make of gas.

INQUIRER.

Parliamentary Intelligence.

HOUSE OF LORDS.

(*Before Lord* WALSINGHAM, *Chairman; Viscount* POWERSCOURT, *Lord* SALTERSFORD, *Lord* DUNSANY, *and Lord* HEYTESBURY.)

BLACKBURN CORPORATION IMPROVEMENT BILL.

(*Continued from page* 686.)

MONDAY, JUNE 27.

Mr. RODWELL having addressed the committee,

The following evidence was called on behalf of Sir W. Feilden:—

Mr. *Robert West*, examined by Mr. MILWARD.

I have been land steward to Sir Wm. Feilden nearly four years. His residence (Feniscowles Hall) was at one time upon the low land close upon the banks of the river Darwen. He has not been able for several years to reside there in consequence of the sewage pollution of the river. That was after the system of drainage for the town of Blackburn came into operation, and drained all the sewage into the Darwen. In order to get rid of the nuisance, Sir William, along with some other gentlemen, took proceedings in Chancery. They have been suspended some time, in order to give the corporation an opportunity of purifying the water. We expected they would have done something, but we are disappointed. The present bill will have the effect not merely of taking away the sewage from Sir William's property in the neighbourhood, but of taking away the water with it. They take away the whole of the water which runs past the hall, which by this scheme is to be used for irrigation. A portion of that water is to be turned out upon the land of Sir Henry de Hoghton as sewage land. Sir Wm. Feilden has a residence called Allum House. The effect of the scheme will be, that although they do not take Sir William's land for the purpose, they will turn the sewage out upon the green property close to the Allum House estate. It is the second best residence on the estate, and in some neighbourhoods would let for a great deal of money. I do not think the river interferes with the house much. The turning of the sewage on to the grass land will interfere very much with the house. Sir Wm. Feilden re-erected the present mill, at a cost of £1300, and he has now let it at £130 a year. It has water power only, but it is a very large and good mill, and I should think it has as good machinery as could be found in any other mill in England. The water affords 20-horse power at least. The mill is in the vicinity of the pleasure-grounds of Feniscowles Hall. If a steam-engine were put up there it would be a great drawback to the comfort and pleasure of the grounds. Supposing the quantity of water to be extracted to be 1,750,000 gallons or 2 million gallons a day, it would either stop the mill altogether, or it would not pay to work it at all without the addition of steam power. In dry weather the mill cannot go to work by two hours so early as it should. At the present time we are very short of water. Unless the mill can be kept working continuously throughout the year the tenants will not keep it on. Sir William will have to make compensation to the tenants for the depreciation. I have already received an intimation to that effect from them. At the present time the Blackburn water is taken out of the sources of the Darwen, and formerly it came down and passed over our wheel. It would do so still, with this difference, that it passes through Blackburn upon its road. By the present bill it is to be carried inward, and turned in miles before us, depriving us of the benefit of it. I believe there was compensation water given to millowners on the upper part of the river, but I never heard of any being made to Sir William. The cost of an engine will be about £1000. The estimated annual cost of working is about £150, and then there would be a depreciation in the machinery. It might altogether be a question of £200 a year, which is more than the rent we receive for the mill.

Cross-examined by Mr. VENABLES: Allum House is 400 yards from the nearest point of the proposed irrigation farm. It is occupied by Mr. James Johnson. I am aware he is a member of the Town Council, who are promoting this scheme. He has not said anything about any inconvenience. There is at present a great deal of nuisance at Feniscowles Hall, which is caused by the mill working in dirty water. If the sewage were taken to filtering works we should lose the water just as much as we would by this scheme. When I said Sir William never had compensation made him, I could not have meant in water, because there is the water now. There are millowners, some above Blackburn and some upon the Eccleshill Brook. The proposed culvert through our land will do us no harm, I think. I gave some instructions for the drawing up of the petition.

Mr. VENABLES: You are aware that in the House of Commons the sole thing complained of was that the sewer would go through your land; neither the mill nor the water was complained of?

Witness: I am fully aware it was inefficiently got up.

By Mr. VENABLES: We are not coming for compensation for the damage the culvert will do us; we come for compensation for the water that will be abstracted. We thought the committee would have admitted our right to the water, and not have quibbled at it.

Mr. MILWARD: The water was not mentioned in the petition, because the gentlemen in the county thought they would get that without a clause; and we raised the question in the House of Commons, and my learned friend objected to because we had not got it in our petition. He shut us out by saying what was perfectly true—"You can go into it in the House of Lords."

TUESDAY, JUNE 28.

Mr. MILWARD, in addressing the committee in support of the petition of Sir Wm. Feilden, said he hoped he should meet with their lordships sanction in adopting the evidence of Mr. Rodwell's clients so far as their cases were identical, in order to prevent repetition with another set of witnesses on some points which had already been laid before their lordships at considerable length. Sir Wm. Feilden, unfortunately for himself and family, possessed the property in the neighbourhood which included Feniscowles Hall, and until Blackburn turned its sewage into the river Darwen, on whose banks Feniscowles Hall was situated, it had been the residence of the family for generations. When the sewage was turned into the river, the residence became so unhealthy and uncomfortable that Sir William had been obliged to reside elsewhere ever since. The river was at one time a pretty trout stream, but it was now turned into a common sewer. Water in Lancashire was life—it was money, therefore it was not merely a question with Sir William of residential destruction, but it was of vital importance to him with regard to the value of the estate. The property being situated between Blackburn and Preston, must be of great mercantile value, and water was necessarily of the utmost importance. Sir Wm. Feilden might, of course, have brought an action for damages, but knowing the difficulty in which Blackburn was placed in getting rid of its sewage, he said, "You must stop this. I do not require you to pay at the earlier part of the proceedings for the damage which has hitherto been done to my estate, but stop it you must. I cannot allow my right as a riparian owner to be destroyed by your sewage works;" and accordingly he applied for and obtained an injunction in the Court of Chancery to restrain the corporation from polluting the river. The corporation appealed, and it was ultimately arranged that Mr. Rawlinson should be consulted to abate the nuisance. No blame could be attached to Sir Wm. Feilden for the course he now took, when it was found, after the matter being three years under the direction of Mr. Rawlinson, that the stream was as bad as ever it was. Then came the question whether the corporation should abate the existing nuisance by the course now submitted to their lordships, or whether, on the other hand, that course submitted would do as much or greater harm and perpetuate the mischief, and involve them in an enormous expenditure, which would hereafter prevent them from taking effective measures for a future remedy of the matter. The scheme affected Sir Wm. Feilden in two different ways. First, as regards the Allum House estate. It was to be supplied with this odoriferous matter poured out upon the proposed sewage farm on Sir Henry de Hoghton's estate, on land within 400 yards of the house. This would be merely shifting the evil out of the river and putting it on land equally near to Allum House. That house was the second mansion on the estate, and was let to a gentleman of Blackburn. The question which would doubtless weigh considerably on their lordships minds was whether it was necessary for the relief of the river that the land should be made in the condition in which the sewage works (as had been represented) would make it. An important point was whether their lordships were so entirely satisfied by the evidence that they would practically close all door for future appeal and future consideration of the question by deciding that the only way of getting rid of town sewage was by irrigation. If there was a prospect of other modes being introduced for disposing of town sewage, their lordships would scarcely inflict upon either Mr. Petre or Sir Wm. Feilden the extreme nuisance and annoyance which must arise from having a sewage farm under their noses. The attention of scientific people was now-a-days so directed to this topic, and the necessity for its consideration had become so pressing, that there could be no doubt that science would in a very short time supply means, if they were not already supplied. He submitted that this was a matter which ought not to be treated as concluded, and that the corporation should not be allowed to spend £180,000 and appropriate any gentleman's estates and houses they pleased for irrigation purposes, which, perhaps, in a couple of years time, would be found to be perfectly unnecessary. It would be a fatal and a strong answer to any proposition which might hereafter be put forward, that the matter was gone into in 1870, and then decided. The suggestion that what was being carried out at Bolton with the sanction of the Home Office and the concurrence of the millowners—viz., depositing and filtering—to some extent might well be left to be carried out at Blackburn until the Legislature interfered with the subject generally, or science had provided some other means. What was to become of Lancashire if in the neighbourhood of every town a sewage farm was to exist? If it was necessary to clear the Blakewater and the Darwen, it was equally necessary to clear the Irk, the Irwell, and the Mersey, and all the confluent rivers on the map. It would be an occupation of sites which would hereafter be excluded from any chance of improvement or applicability to purposes of manufacture or commerce. With regard to the water question, his learned friend, Mr. Venables, stated that Sir Wm. Feilden had been compensated for his loss of water by virtue of the Act of Parliament which constituted the water company. He (Mr. Milward) had read the Act, and could not find that it was so. The facts were these. The water was drawn from the watershed, or water-collecting area of the upper part of the river Darwen, above the town of Over Darwen. It ran down to the junction with the Blakewater; it was called the Darwen down to there, and still continued to be called the Darwen right along. In going to take a portion of that watershed from the sources of the Darwen into the valley of the Blakewater—*i. e.*, to divert a part of the Darwen into the Blakewater Valley above the junction—of course they were going to deprive certain millowners upon the upper portion of the Darwen above the park, and upon Eccleshall Brook, which ran into the Darwen above the fork, of all the water, of course, which drained into the watershed of the Blakewater, and which they gave to the town of Blackburn, but they were not going to deprive the millowners or proprietors below the junction of one drop of that water. Every drop of that water would come back again to the Darwen at

the junction, having simply made a detour through Blackburn, and ultimately going into its natural course at the junction of the two rivers, so that there was provision made in the water Act for making a compensation reservoir to supply water down the Eccleshall Brook and the river Darwen, which was for the use of the millowners, who would otherwise be deprived of all the water. The gentlemen holding mills upon the upper part of the Darwen above the fork, and upon the Eccleshall Brook, both of whom were going to be deprived of this water, would, of course, be entitled to compensation. There would be nothing abstracted from Sir Wm. Feilden, because all the water came into this after it passed the junction. He was not a complainant; on the contrary, he was going to get the water in a more average and consecutive quantity, and so would be advantaged by it. With all his learned friend's ingenuity, he could not make out that Sir William was compensated for suffering nothing, and it was quite clear that, compensated or not, in 1845 (as their lordships had just put it) they were going by this bill to take away from Sir Wm. Feilden the actual quantity of water now used for irrigation purposes—viz., 1,750,000 or 2,000,000 gallons a day. That quantity of water was not compensated for; his client had it throughout, and it was now to be turned out of the stream, and a small body only allowed to go back to the stream after it had passed by the riparian estate of Sir Wm. Feilden, so that Sir William was a clear loser. There was also the loss of an additional figure of water—namely, the drainage of the streets of Blackburn itself—which, of course, would naturally go into the Blakewater, but which would now be diverted into the sewer, and all the streams above the town would be turned away from his client. The representatives of the Town Council had given the figure of water at 2 million gallons a day, which was a large quantity. His learned friend said that loss had been compensated already. The House of Lords did not think so. A similar case was that of the Duke of Buccleuch, who had been awarded £8000 by the Metropolitan Board of Works for the deprivation of his estate on the banks of the Thames. The board would not pay him, and he brought an action against them, and it was decided a few days ago by the House of Lords saying that, as a riparian owner, he had no right to compensation. It was in consequence of such decision that he (the learned counsel) urged their lordships that it was necessary to protect the interests of Sir Wm. Feilden by a clause. This was not, however, the ground on which he opposed the preamble of the bill, but the opposition arose from the positive deprivation of water from Sir Wm. Feilden's estate unnecessarily, which would have the effect of interfering with the management of the estate, and with the way in which it had been laid out, and would have the very important consequence of interfering with the future application of that estate to commercial purposes, if it were thought fit, as well as the present enjoyment of the estate as having its regular flowing river. The water came in actual regular quantities in winter and summer. Summer was, of course, the time when it was of the greatest value, because then the natural streams were almost dried up; so that, in point of fact, instead of having the 2 million gallons of water flowing by, there was to be left merely, so to speak, a dry bed to the river. His learned friend would say this was a question of steam power. It was, however, one thing in a gentleman's own pleasure-grounds to have the water of an ordinary stream running over the wheel of a water-mill, but it was a very different thing to have a steam-engine on the premises, with its smoke, noise, and other abominations. It was not a mere question to his client of pounds, shillings, and pence, but it was a question to him of water, of the value and enjoyment of it. The learned counsel concluded by asking their lordships that this bill might not be allowed to pass.

Mr. Venables, in his reply on behalf of the corporation, said he hoped his learned friend Mr. Milward would not think himself treated with any disrespect if he passed very shortly over Sir Wm. Feilden's case, for he (Mr. Venables) could hardly suppose that if their lordships thought this was a desirable scheme otherwise, Sir Wm. Feilden's objection would prevail against it. In Sir William's petition to the House of Commons the only allegation he made in reference to his injury was that a portion of his land would be taken for a culvert—for none of his land was required for other purposes. He forgot his mill—he forget the abstraction of his water; and, although his learned friend now calmly stated that he never would have objected to the culvert passing through his land, Sir William absolutely, in his petition objected to nothing else. When Sir William applied to the Court of Chancery to prevent the corporation draining in any way whatever from their sewers into the Darwen, did he or did he not mean to say they were to abstract water from the Darwen? He said they were not in any way to drain from the sewers. Surely the only alternative was to take the drainage somewhere else, which was just what the corporation were about to do. One of the anti-irrigation schemes suggested was to take the sewage to filter-beds on Sir Henry de Hoghton's land, which was just as far below Sir Wm. Feilden's as the place to which the corporation were going to take it. By any process, except the dry earth process, which his learned friend had not set up, they must take the water from Sir Wm. Feilden. The compensation for water was as clear as possible by the water Act. Sir William was compensated, and got this additional compensation water, and it was well known that in all such cases the compensation water was much more than adequate for that abstracted, because it secured a supply in dry times. It was true Sir William would have also had that which came out of the sewers. The corporation were not bound to deliver any if they could have found any other way of disposing of it. The water company might have taken it away if such had been their interest. Sir Wm. Feilden had the same compensation as the millowners above the Blakewater who got none of the sewage. The occupier of Allum House was an active supporter of the bill, and there was no reason or proof that he was about to leave. With regard to Feniscowles Hall, it was at present uninhabitable by reason of the stench, which stench the corporation were about to remove. With reference to his learned friend's argument that, if every town in Lancashire adopted this plan, it would require 42,500 acres, there were 2,500,000 acres in Lancashire, and the result would be that 42,500 acres would be much more fertile than they were at present. He (Mr. Venables) could not deny that Mr. Petre's opposition was a serious opposition. It was no doubt a grievance to any gentleman to be obliged, for public purposes, to give up land which he desired to retain. The corporation were obliged to take some land, and that, on the best advice they could get, they proposed, with their lordships sanction, to take some of Mr. Petre's land. It had not been seriously contended that there was any other land applicable to the purpose. The 10,000 acres in the immediate neighbourhood referred to by Mr. Drysdale would be open to the same objections as those raised upon Mr. Petre's land. Mr. Slatter's suggestion of the reclaimed marsh land was a mere afterthought on the opponents side, and, for aught they knew, might cost £50,000 or £100,000 more than the present scheme. That land was a dead flat, and would be peculiarly unsuitable for the intended operation, because it was a great advantage to have a slope, so as to enable the water to pass from one thing to another. Had the corporation any interest in adopting an expensive plan? They were burthened with heavy rates in consequence of the cotton famine, and they came here, with the best advice they could obtain, to get as cheaply as possible the only plan which, carried out, they thought, would be efficient for the purpose. The petitioners should have shown that the marshes were mechanically, economically, and commercially useful for the purpose. It was not fair on the part of the petitioners against a serious contention like that of the corporation to let nearly every witness start a new doctrine of opposition. The petitioners were bound, if they meant a serious opposition to the scheme, to select some one plan, and to insist upon it, because every one of those witnesses more or less weakened the effect of the other witnesses. Thirteen or fourteen committees, commissions, and other bodies, had unanimously reported in favour of the irrigation system, and Parliament had passed two Acts for the purpose of facilitating sewage irrigation. It was suggested that it would poison the country, spread the cattle disease, introduce tape-worms in the intestines of half the community, and do other kinds of shocking things. If Mr. Petre had not objected, the corporation could have carried it out without anybody having an opportunity of saying so. Supposing they had agreed with anybody to buy the land, they could have gone under the General Act, have got all the necessary powers, and nobody could have opposed it except the landowners whose land had been taken. Mr. Petre alleged it was not desirable to take his land for several reasons. It was said to be building land. "Building land" was an ambiguous phrase. Every piece of land might in one sense be called building land. Witnesses thoroughly acquainted with the land gave it as their opinion that it was not building land, and stated in support of that opinion that there had not been a single detached house built between Preston and this point for the last 30 years. Mr. Petre would be compensated not merely for the land taken, but for the diminished value (if it was diminished) of the land left. It was not a proportional diminution of this estate to take so much acreage, and one local witness stated there was a much greater demand for land in small than in large quantities, not for building land, but for little occupations. The offer of the corporation for the land was at the rate of about £122 an acre, and this was to pay for land let for £1 or 30s. an acre. If hereafter the land was wanted for building purposes, no doubt in the close vicinity of the farm it might be deteriorated; but farther off towards the Ribble it would not be deteriorated at all, being there actually out of sight of this land, and separated from it by a ridge of hills, without the possibility of the effluent water coming into that district at all, because it could not run over the ridge. With regard to the evidence about other sewage farms, some of the witnesses, being excited, had stated that they not only disliked sewage farms themselves, but that everybody else disliked them; but they were mistaken. People did not dislike them enough to make them leave their houses. It was shown at Norwood that there had been a large extent of new building since the sewage farm was there. At Carlisle some of the best residences of the town were separated merely by a river from the sewage farm, being at such an elevation that they would get any effluvia, if such effluvia arose. He would now approach what was perhaps the most important part of the case. There was Mr. Petre's interest (which he had already dealt with) on the one hand, and the enormous importance to Blackburn on the other; Among the various schemes suggested on the other side he would first dispose of Mr. Spencer's. This witness declined to tell what his filter cost, and he did not pretend that it was applicable for filtering sewage. He came merely to lend the weight of his eminent name to the opposition, but not to support one of the alternative schemes set up by them. So, again, with regard to Mr. Rideout, whose system did not render water drinkable or innocuous, but merely bright and colourless, and useable for his particular purposes. The sewage of Bolton formed about 1-15th of the water of the river Croal at Mr. Rideout's works; therefore, instead of filtering sewage he would be filtering sewage *plus* 1500 per cent. of water. Mr. Rideout's filters would not filter the sewage of Blackburn for a day, because they would get clogged immediately; 40 acres of land would be required, and the process would cost £288,400. Mr. Rideout's scheme was merely a process for purifying river water polluted with sewage, and not for purifying sewage water. Two or three witnesses advocated the system of dry earth closets or ashpits, but high authority had stated that system could only be safely adopted in places where discipline and minute supervision could be exercised—such as gaols, schools, and asylums—and that for a large town that necessary supervision could not be exercised. Some other plan must be adopted. His learned friend thought himself at liberty to suggest that there were a dozen others, and the very fact of his taking three or four alternatives showed that he had no one alternative upon which he ventured to rely as being a substitute for the promoters plan. The weightiest part of the petitioner's evidence on the subject was in favour of the intermittent filtration scheme. Mr. Harrison strongly recommended the filtering process, but admitted that, when on the Pollution of Rivers Commission, he reported in the strongest possible way in favour of sewage irrigation. He quoted the authority of two of the promoters witnesses, Mr. Morton and Dr. Frankland, as the sole basis of his opinion; and stated that he would not have been here but for their report. Everything, Mr. Harrison said, was consistent with that. He said that he found in the report that chemical treatment, followed by filtration, would dispose of a nuisance. He (Mr. Venables) did not dispute that at all, and the witness stated (having never seen an experiment) that he was convinced of that, by the authority of Dr. Frankland, Mr. Morton, and Sir William Denison. Dr. Frankland's opinion had not been shaken by the cross-examination of the other side in the slightest degree, and surely he was a greater authority than Mr. Harrison, if not about sewage irrigation, at any rate about what he meant by his own words, and what was his own opinion. Dr. Frankland, who (with Mr. Morton) was the only authority for the filtration system, distinctly objected to its being tried, and he had told the committee that one of the conditions of that system was that not only must they have the great expanse of 40 acres of filtering-beds, but that they must create a most formidable nuisance, and it had been suggested that the promoters should create that nuisance immediately under Sir Henry de Hoghton's house. It had been agreed with Sir Henry, subject to the bill passing, to buy that land from him for irrigation purposes. Was it likely that they could get that land from him, because the bargain would be at an end if this bill was lost, and the thing must be reopened? Was it likely that land could be got from Sir Henry for the purpose of causing this intolerable stench on 40 acres? Nothing was more improbable or unlikely. Dr. Frankland was perfectly justified in dwelling upon the importance of not altogether wasting the manure. It was, indeed, suggested that it would not be wasted but be utilized by the A. B. C. process. No estimate was presented of the expense of the A. B. C. process, but, assuming that it would not come to much, still the value of the manure was destroyed. Dr. Frankland, Dr. Odling, Dr. Voelcker, and Mr. Morton had agreed that it was absolutely worthless. As a vehicle it would be worth a few shillings, *minus* the expense of carrying it on to the ground. The A. B. C. Company had contrived to get some farmers so simple-minded as to pay from £3 to £5 for this good-for-nothing stuff, but it appeared that, for the purpose of getting even an ostensibly useful manure, the company had to go through the process of adulterating it with ammonia, which cost them a great deal more than they sold it for. Mr. Hawksley and Mr. Harrison had both affirmed that the value of the manure consisted in the things which were put into it after it came out of the tank; that they never could have been put in for the purpose of clarification, and of course it was done to get up a market until the time that the manure was worth something. This market price would be about 2s. or 3s. a ton. Speaking merely as to the commercial value, it was a thing of great importance not to destroy all this valuable manure, which, in the form of sewage irrigation, was capable of adding very largely to the productiveness of the land. That was all clear gain, whether it was a commercial gain or not, and that was a false issue which was repeatedly put by the other side. A thing could only be called a commercial success when it was a commercial speculation. In this case there was a necessity for getting rid of sewage. He contended this plan was vastly cheaper than the filtration scheme, and that, in addition to its cheapness, it would produce, if not a profit, a certain return. It was not a question whether it was a good investment to do it. Did any one suppose that the corporation were anxious to get rid of £189,000, and to burden themselves and the town to that extent? They would be very glad to avoid it, but the land was estimated at £142,000, and that would be a certain property purchased. He admitted that those who bought compulsorily always got something which they could not sell the next day for as much. Supposing there was a loss of 10 per cent., and supposing the land worth £125,000, and could be sold next day for that amount,

the difference between these two sums, he admitted, was so far gone. The promoters proceeded by the expenditure of £47,000 more, to raise the value of the land from £1 or 30s. an acre, to what could not under the circumstances be less than £5 or £6 an acre, and that would give a very ample interest, not only on the £47,000, but on the money sunk in buying the land. The promoters would get the rent of the land, and that would pay them, except that they would have to buy it at a high number of years purchase. They would get the ordinary rent of the unimproved land in its present state to compensate them for the outlay. That would not, of course, be an adequate compensation, but the expenditure of £47,000 would produce a high rental in the course of time. Being conveniently situated, they would supply two market towns with their produce. They would have an abundant and unlimited market for their milk. They would not only benefit the inhabitants, but would ensure to themselves a market for ten times over all that they would ever have to dispose of. The evidence of Mr. Morton, Mr. Hope, and Mr. Blackburn, each a proprietor of a sewage farm, went to prove the abundance produced by irrigation. With regard to the alleged nuisances of these farms, what was the value of the evidence on the other side relative to the visit of some gentlemen to the Aldershot farm, and their finding a neglected ditch, and the sewage running to waste? That was part of the promoters case. The promoters said that if sewage ran anywhere but over the land it would be an enormous nuisance, but in the present case it would be a nuisance to themselves and tenants only, because the proposed land sloped down both ways to the Darwen. Had any one shown that one single person in Blackburn disapproved of this scheme? As far as it appeared to their lordships, Blackburn was absolutely unanimous in favour of it. His learned friend, Mr. Rodwell's, remark, that if this bill was passed all the corporations in the kingdom would be immediately rushing for bills, was rather inconsistent. Mr. Harrison suggested that it was a great hardship for them to be compelled to adopt this plan. The alternative of filtration had never yet been tried except in Dr. Frankland's laboratory, and there was not at that moment one single filtration system at work in England. The result of the Leamington attempt was that the filters were choked, and they were obliged to abandon them. The learned counsel, in conclusion, submitted to their lordships that there was an overwhelming weight of evidence in favour of irrigation of land, as compared with any or all of the alternative schemes. If the bill was rejected, the result would be to throw the promoters again upon the world with the decree immediately impending over them, which would undoubtedly be confirmed, to prohibit their sending the sewage into the Blakewater, and it would force upon them the necessity of coming in a future year for a bill, not under a general Act, because Parliament had never provided a general Act for any such purpose, but with a private bill for the purpose of getting 40 acres of filter-ground in the neighbourhood of Blackburn. They would then be met with the opposition of the landowner. They would be asking for power to expend, probably, double the sum now asked, and without a hope of partly recouping themselves and fertilizing the land as they would do by the present scheme. The result would be to create an enormous nuisance, and to carry forward, at the expense of the community of Blackburn, an experiment which the very author of the system, Dr. Frankland, most strongly recommended them not to carry out on such a large scale, telling them that it would be injurious in itself. He thought he had convinced their lordships by his witnesses that it was absolutely necessary the promoters should have this power, and that they would be enabled to dispose of their sewage in this manner. The other parts of the bill were unopposed.

The parties were directed to withdraw, and on being again called in,

The CHAIRMAN said: The committee have decided that the preamble of the bill is proved so far as regards taking the land which is proposed to be taken by the bill. With respect to Sir Wm. Feilden's case, I think that the promoters offered a clause.

Mr. VENABLES said he should like, before he offered a clause, to take the chairman's opinion as to whether Sir Wm. Feilden was not entitled, under the General Act, to compensation if he lost any water.

The CHAIRMAN said it seemed a difficult legal question whether Sir Wm. Feilden was entitled to the water which had been allowed to run down from Blackburn. When that water was taken for the water-works a certain compensation was given, and he thought it was difficult to say what the compensation now to be given was.

Mr. MILWARD said he would put the matter out of all trouble by proposing a special clause. He was sure their lordships would not leave this question in doubt, and that they would not sanction that Sir Wm. Feilden should be absolutely deprived of his mill, and all his future water-right taken away without compensation. His learned friend, Mr. Venables, had defeated his (Mr. Milward's) opposition on that head by saying he would give Sir William a clause, whether he got the compensation under the General Act or not.

Mr. VENABLES said that he had stated that if it should turn out that the General Act did not apply to the case, Sir Wm. Feilden should then have a special clause. His learned friend had not attempted to show that the General Act did not apply to this case.

After some further discussion,

Mr. MILWARD read the proposed clause—"The corporation shall pay to the said owner for his interest, if any, in the water diverted by their works from his mill, as may be determined in accordance with the provisions of the Lands Clauses Consolidation Act."

Mr. VENABLES said he would agree to the following clause:—"Provided always, that if in the exercise of any of the powers of this Act the corporation permanently divert to any point below the site, on the river Darwen, of Feniscowles Mill any water of the river Blakewater, to the continuance of the flow of which into the river Darwen above the said mill the owner or owners of the said mill have any prescriptive right, the corporation shall make compensation for the same."

After some further discussion, this clause was agreed to with the omission of the word "permanently."

Mr. RODWELL proposed on clause 68 (which fixes the time for completion of the sewage works) that it should be altered from seven to three years. He also proposed to put the following provision at the end of the clause:—"And all lands which shall have been acquired by the corporation under the 69th section of this Act, and which shall not have been used, or which shall have ceased to be used by the corporation for the purpose of purifying the sewage of the borough of Blackburn, shall be resold to the vendors thereof, or their successors in title, should they so require, by the corporation, at such price not exceeding that which the corporation originally paid such vendors for the same, as shall be awarded by arbitration in manner provided by the Lands Clauses Consolidation Act, 1845, for settling cases of disputed compensation."

Mr. MILWARD supported this clause on the part of Sir Wm. Feilden.

Mr. VENABLES opposed both the amendment and the clause.

After further discussion,

The CHAIRMAN stated that the committee were not disposed to alter the time.

Mr. VENABLES, in opposing the clause, said that its object was not to get the right of pre-emption, because Mr. Petre already had it as it was given to him by incorporating the Lands Clauses Act. Why should Mr. Petre have the land at the price the promoters paid him for it? The promoters might have expended £20,000 on it, and under the proposed clause he would be entitled to take it back at the price paid. It was a monstrous thing.

Mr. RODWELL said he did not mind cutting out the last part of the clause. He wanted to prevent, in the event of the corporation ceasing to use this land, their afterwards converting it into any other purpose without giving the petitioner the power to purchase.

After a conversation, their lordships consulted together.

Mr. VENABLES raised another point. He said this proposed clause applied to land not to be used. The promoters by the bill took 200 acres more than they could use at present, because they calculated upon an increase of population. By this clause at the end of seven years they would be compelled to sell it if they did not use it. Until the population of Blackburn reached 20,000 more than at present, there would necessarily be unused land, and the promoters must have power to deal with that land in the meantime. Was it to be said that they could not let that land to a tenant?

The CHAIRMAN (to Mr. Rodwell): I am afraid that we cannot give you that clause.

Mr. RODWELL then proposed the following clause:—"The corporation shall not let to a tenant any lands used or to be used for a longer term than one year, and then only subject to three months notice to quit, to be given at any time if the lands shall be so used by the tenant thereof as to be offensive or the cause of a nuisance." He asked this for the neighbourhood. The works were apt to be mismanaged by the tenants, and if the tenant had a longer lease he could not surrender it.

Mr. MICHAEL objected.

The CHAIRMAN: We cannot admit that clause.

Mr. RODWELL proposed one more clause, which was to the effect that the corporation should be liable for their tenants in case of a nuisance proceeding from the works, and that persons so affected should be entitled to any legal proceedings which might be taken had not this Act been passed. Provided that the fouling of streams should be deemed a nuisance, and that any person thereby affected should claim monetary compensation for any loss or injury so sustained, the amount of such compensation to be settled in the manner provided in the Lands Clauses Consolidation Act.

The CHAIRMAN: Does not clause 80 do all that is required?

Mr. MICHAEL: We think so, my lord. In drawing up this bill we quite intended that a strong pressure should be put upon us, that no nuisance should be created by these works.

The CHAIRMAN read clause 80, which is as follows:—"Nothing in this Act shall exonerate the corporation from any indictment, action, or other proceeding for nuisance or damages, in the event of any nuisance being caused by them in conveying or disposing of the sewage or refuse from the sewers, or in any other manner, or of any damage occurring from the want of repair of any of the works of the corporation."

Mr. RODWELL: I suppose that any person under that 80th section would have to prosecute the corporation by indictment.

Clause 79 was then amended by agreement.

Mr. MILWARD proposed on behalf of Sir Wm. Feilden the following clause:—"The works of the corporation on the land so taken shall be executed according to plans to be approved by, and in all other respects to the reasonable satisfaction of, the surveyor for the time being of the said owner."

Mr. MICHAEL said it would be an absolute veto by the surveyor to stop the works. There was no precedent for anything of the sort.

After a conversation,

The CHAIRMAN said: If there is any danger of Sir Wm. Feilden suffering any injury, we wish to protect him, and I think that the clause which Mr. Milward proposes is a very reasonable one.

Mr. MILWARD said he had put in his clause that the expenses should be borne equally. Clause 74 of the bill ran: "The corporation may, under any agreement with the owners or occupiers of any lands contiguous to the conduits or works of the corporation, supply to such owners or occupiers respectively sewage for the fertilization of such lands." The effect of that was that they need not do it unless the petitioners chose to pay what they chose to charge. If the petitioners estate was used for the promoters purposes, the common idea would be that the petitioners would be entitled to any benefit which could be got from it, and he asked their lordships that in case of disagreement the price shall be settled by arbitration under the Lands Clauses Consolidation Act.

Mr. MICHAEL expressed his acquiescence, and the clause was arranged between the parties.

On clause 2,

Mr. MICHAEL said the agents would bring up the clause to-morrow morning in the form upon which they would mutually agree.

On the following day the clause so prepared was adopted, and the bill passed through committee.

Legal Intelligence.

CONVICTION OF A GAS COMPANY FOR FOULING WATER-WELLS.

At the Canterbury Police Court, on Thursday, Sept. 15, the directors of the Canterbury Gas and Water Company were summoned by Mr. George Felix Finn, landlord of the Sovereign Inn, Castle Street, for permitting an escape of gas from their works, whereby water in a well at the rear of his premises was rendered unfit for use.

Mr. R. E. WEBSTER appeared for the plaintiff, and Mr. BESLEY for the company.

In opening the case, Mr. WEBSTER said that up to the beginning of this year Mr. Finn had been supplied with water from the old water-mains by the defendants, the supply being gratuitous in consequence of the water in his client's well having been, like several other wells, injured by the company's gas. In June last the company served a notice on his client to the effect that the old water-mains were about to be cut off, so that the water hitherto supplied him by the company would be discontinued, and that application must be made for the new water. At about the same time Mr. Finn received information that the leakage from the gas-works, by which his water had been damaged, had been remedied, and in consequence of this he opened his well, but found the water was still impregnated with gas and unfit for use. He had his well emptied, and tested the water as it came in, and found that, instead of its being pure, it was still more impregnated with gas. Under these circumstances, Mr. Finn served a notice on the company, on the 24th of August, calling their attention to the section in their Act which enacted that whenever any water within the limits of the company was made foul by gas or washing from gas, supplied by the company, they should, after 24 hours notice, remedy the nuisance, and that if they failed they should be liable to a penalty not exceeding £20 for every offence, and 10s. for each day the offence was continued after the expiration of the 24 hours. Since Mr. Finn had served the notice he, in common with others, had examined the water on several occasions, and every time found it was still impregnated with gas. He did not know whether his learned friend was going to deny that any leakage existed on the company's premises, but he should prove that such leakage did exist, and that, in consequence, his client's water had been injured. Mr. Webster then explained the cause of the leakage chemically speaking, after which he continued to observe that Mr. Finn did not take these proceedings with a view to muleting the company in damages, but in order to make them discontinue damaging the water. He then produced the notice Mr. Finn served on the defendants, which was to the effect that the company had allowed an escape of gas from their works, whereby the water in his well had become soiled, foul, and corrupted, and giving them 24 hours notice to remove the nuisance.

Mr. *Finn*, the plaintiff, said he was the landlord of the Sovereign Inn, Castle Street. Previous to last June he was supplied with water from the old water-mains by the company, the defendants in this case. He had a well upon his premises. In June he was served with a notice from the company, to the

effect that the water supplied him gratuitously would be discontinued. Subsequent to receiving that notice he opened his well, as he contemplated using water from it. He knew the water had been damaged by the gas from the defendant's premises, and when he opened the well he found the water looked clear and as if nothing was the matter with it. He commenced emptying the water out. He then discovered the water was impregnated with gas. It smelt strongly of gas. In consequence of this, he instructed his solicitor to serve a notice on the company, requesting them to remove the nuisance within 24 hours. Since the expiration of this notice he had again examined the water, and every time found it strongly impregnated with gas. He had tasted it. He examined it that morning; it was in the same state. He knew the water in several other wells in the parish was in the same state as his.

Mr. BESLEY raised an objection to Mr. Webster mentioning other cases in support of his.

Mr. WEBSTER contended that he had a right to ask whether other wells had been injured, because if there had been any leakage of gas at all it was strong evidence for him if he could show that leakage had impregnated other water besides that in Mr. Finn's well.

The BENCH decided that Mr. Webster should confine himself to his own case.

Examination continued: He had not brought any water from his well with him. He could get some. [A bottle of the water was fetched, and it was handed round to the magistrates, who gave it as their opinion that there was gas in the water.] The manager of the company (Mr. Moorhouse) had told him the water in his well would be found all right, as he had attended to the leakage, and about two months after he opened his well, and found the water still impregnated with gas. The well was opened in 1869, when the water appeared pure. It was not tasted.

Cross-examined: There were four taps in his house, from which the water supplied to him from the old water-mains was drawn. There were two on the ground floor, one in the cellar, and one upstairs. The water was supplied gratuitously, and he was using it now. He knew there was a leakage from one of the gasholders in about the year 1854. It was in consequence of this leakage damaging water in wells that the company supplied him and others with water gratuitously. He had been supplied with gas from the company up to March last year. He had the gas cut off. He did not know of any escape in his gas-pipes. He had never examined the pipes. He should think it would be impossible for an escape of gas from the pipes in his house to damage the water in the well. The gas-main was more than 15 feet from the well. He knew the Act of Parliament allowed parties all expenses for digging up the ground to ascertain the cause of water being damaged. He had not had his ground dug up. His idea was that the water in his well was polluted by gas that escaped from the defendant's gasholder-tank. In 1867 he did not taste the water, neither did he empty the well. The depth of the well was 11 or 12 feet. The nearest cesspool was 16 feet from the well. He had had nearly all the water taken out of the well. The water came from a spring. It did not come in so fast as it was taken out. He had seen it come in, and then he had tasted it and found it impregnated with gas. He would not be content, if his complaint was well founded, to have water from the company free of charge. He preferred well water to the company's. He came there for a conviction, if he could get it. He wanted both a conviction and £20 damages, if he could get them. He supposed £20 damages would follow the conviction.

Re-examined: The object of his coming there was to get a good supply of water from his well. He did not wish to make the company pay a heavy penalty. Before he commenced these proceedings he took steps to get the company to supply him with good water. The company had not offered to supply him with the water free of expense.

Mr. *George Cole*, plumber, &c., Castle Street, said he was one of the complaining parties against the defendants. In August last he was present when the well on the plaintiff's premises was opened. He assisted in taking the water out of the well. The water was strongly impregnated with gas. The fresh water that kept springing in was in the same state. It was his opinion the water was impregnated with gas. He should have not the slightest doubt about it.

Cross-examined: The water he smelt in the well was much more strongly impregnated with gas than that now produced. He could not trace any gas in that water produced. He might be able to do so if he were a chemist.

Re-examined: The water at the top of the well was not so bad as that lower down. He had examined the water in the presence of the gas directors. He had also examined water in other wells, and found it impregnated with gas. He was chairman of a meeting held to consider the question of the pollution of water in wells by the gas company. Several meetings were held, and deputations were sent to the company. He was one of the deputations. He produced a notice from the company expressing their willingness to supply those people, whose water had been contaminated, with water from the new water-works at half the price paid by ordinary consumers on certain conditions.

This was the case for the plaintiff.

Mr. BESLEY then addressed the bench for the company. He said he must, in the first instance, ask the bench to decide a point of law for him. It was as to the notice served on the company. In a section of the company's Act it stated that the notice should be of the offence upon which the bench were asked to convict. Now, in comparing the summons with the section, it was found that it was not properly worded. The terms of the section were, "water fouled by certain gas." The section was addressed to one object only, that of permitting a leakage of gas, and not water. It was gas only; and to make this plainer, he might mention that if ground was dug up, and it was found that water was fouled by gas, the company were liable to pay the cost of the examination, &c.; but if it was not proved that gas was the cause, the parties directing the examination to be made had to pay the expenses. The notice served on the company by Mr. Finn was worded in this manner—that the company had allowed certain washings from gas to be drained, conducted, or conveyed into Mr. Finn's well. The learned barrister then went on to say that the plaintiff, or his solicitor, had committed an error in making out the summons. They had drawn up the summons under the old Act of Parliament, which had been repealed, but, notwithstanding this, the notice was good. Mr. Besley then submitted that the plaintiff had not acted properly in these proceedings. He said himself he came there for a conviction, and damages too if he could get them, and he had served both a writ and a summons on the company, with the evident intention of the one serving the purpose of the other.

The MAGISTRATES here interposed, and asked Mr. Besley if he wanted them to decide a point for him, and he having replied in the affirmative,

The BENCH replied that they considered it was too late now for him to raise an objection. He should have done so when the case was first before the bench, on the 29th ult., when an application for its adjournment was made.

Mr. BESLEY continued: He only wanted the decision of the bench upon the point he had raised, so that he could take advantage of it when an appeal against the magistrates decision, if it were against the company, was heard.

Mr. WEBSTER: I want the magistrates to understand one point. The company agreed not to appear to a notice we served on them at first, because it was made out in a wrong name. They only recognized a subsequent one.

Mr. BESLEY, in continuing his address, observed that he was sure the bench would deal with the merits of the case on both sides fairly. It was important to joint-stock companies that they should have everything granted them that would cause them to succeed, but they had no right to oppress any one. After a few more observations on other matters, the learned gentleman remarked that the defence to the charge made against the company would be that the offence complained of was of many years standing—as far back as 1854—and that it was not committed by the present company, but by the former one. It was true that the old company did commit some such an offence as that complained of. An escape of gas took place from the gasometer, and the gas found its way into the wells in the neighbourhood. That was years and years ago, and it had been remedied since. He should prove in evidence that the present company had not committed the offence, neither had they continued it. He should prove clearly that the company had not committed the offence within six months previous to the present proceedings being taken. It appeared to him that these proceedings were an attempt to get the new water all over the houses of those who had been supplied with water under the old system free of charge. A conviction was asked in the year 1870 for an offence committed between 1854 and 1859. He very much pressed upon the bench the terms of the section of the Act of Parliament as to the cause of the water being contaminated, and he very much questioned if the manner in which the plaintiff had proceeded in this case was proper. He could not refrain from making one observation before he concluded his address. It was this—that he hoped one summons would be considered sufficient, and that the bench, if they convicted in this case, would not allow the other four cases set down for hearing to proceed. Mr. Besley then called the following witnesses:—

Mr. *Harry Good* said that from 1839 to 1866 he was manager of the late Canterbury Gaslight and Coke Company. In 1851 the gasholder-tank, on that side of the road in which Mr. Finn's house was situated, leaked. The first complaint was made in 1852 or 1853. The complaint was that water in wells in the neighbourhood had become impregnated with gas. The parties who complained were supplied with water free. The tenant of the house now occupied by the plaintiff was one of the complaining parties, and he was supplied with water free. The last time witness knew Mr. Finn's well was used was between 1852 and 1853. Where the gasholder-tank in question stood the ground was higher than the well on the plaintiff's premises. The gasholder was 16 feet deep. The place where the water was was 4 feet from the ground. On the leakage being discovered the tank was repaired, but a sound job could not be made of it, and the gasholder continued to leak up to 1866. It was used all the time.

Cross-examined: The outside of the gasholder was made of brick and puddle. The fault was in the puddling. The gasholder was only tried once while he was there.

Edward Eves, inspector of meters in the employ of the defendants, said he did not know in what state the water in the plaintiff's well was when the water was supplied to the house from the old water-mains. He superintended the taking away of Mr. Finn's gas-meter. There was no leakage from the gas-pipes. He did not believe there was any leakage in the gas-pipes in the locality in which the plaintiff's house was situated.

Cross-examined: He had not taken up all the mains in the locality to see if there was any leakage. He had not heard of there being any leakage. Mr. Finn's house was below the level of the tank on that side of the road.

Mr. *Robert R. Moorhouse*, the manager of the present company's works, stated that the gasholder-tank in question had been examined by him every month. There had been no leakage from it since he had been the company's manager. He could tell if there was a leakage by the water decreasing in the tank. He could state positively there had been no leakage since 1869, when he became manager.

Cross-examined: The water for the tank was let in from the top by means of a pipe. The tank was 70 yards away from the other tanks. He had supplied water to both tanks on one side of the road, but not to the one on the side of the plaintiff's house. To the best of his belief there was no outlet in the tank in question. He had not put any water in, so he could not tell.

Mr. *James Burch*, the secretary of the company, deposed that the gasholder-tank in question was supposed to leak in 1866, and something was done to it in 1868. It was emptied of water entirely, the bottom was repuddled, the inlet and outlet pipes were taken out and larger ones substituted for them, and the outside of the tank was repuddled. He had not the slightest doubt that it was water that escaped from the tank. In July this year he measured the water in the tank, and in 48 hours afterwards he measured it again, and found it just the same. There had been no leakage, to the best of his belief, since the tank had been repaired in 1868.

Cross-examined: The gas-tank in question leaked from 1851 to 1868. He did not know what became of the refuse from the gas. He had nothing to do with the practical part of the works. There had never been a complaint of leakage in the other tanks; there was, however, a supposition amongst the company's officers that there was a leakage. If there were any wells in the town polluted, he should attribute the cause to the escape from the gas-pipes.

Re-examined: He believed it was utterly impossible for a leakage from the tanks to affect Mr. Finn's well.

This was the case for the defence.

Mr. WEBSTER put in a letter written by Messrs. Wightwick and Kingsford, the company's solicitors, and sent to Mr. Finn, stating that the company had agreed not to appear to the writ served on them by the plaintiff's solicitor, as it was made out in the wrong name.

The bench then retired to consider their decision, and, on their return into court,

The CHAIRMAN said the magistrates had considered the case in the best possible way, and had come to the conclusion—and it was perfectly unanimous—that the charge against the company had been made out, and they inflicted a penalty of £20; and the company would also have to pay 10s. for every day that had elapsed since the service of the summons (the 24th of August), during which time the offence was continued, together with the costs of the proceedings.

Notice of appeal was given. There were four similar charges against the company, but they were adjourned.

Miscellaneous News.

BRADFORD TOWN COUNCIL.

An Ordinary Monthly Meeting of this Council was held in the Court-House on Tuesday, the 20th inst. The MAYOR presided, and there were also present Aldermen Scott, Dawson, Brayshaw, Law, Terry, West, Sutcliffe, Rawson, Cole, Leeming, and a large number of councillors.

The minutes of the Smoke Prevention, &c. Committee included as special business a resolution authorizing the town-clerk to prepare a draft bill for the ensuing session of Parliament for enabling the corporation to supply the borough with gas, with all necessary powers to purchase lands, construct works, and raise capital; and also for obtaining powers to enable the corporation to acquire, by agreement or otherwise, the plant and works of the Bradford Gas Company. In moving the adoption of the minutes,

Alderman SCOTT said: I wish to call the attention of the council to a letter from the deputy-chairman of the gas company, in reference to the report presented to the council at its last meeting, in which it is alleged there are "several misrepresentations." The writer says that "the framers of the report have evidently overlooked the fact that the opinion of Sir Robert Collier and Mr. Hannay only applies to any 'excess of reserve-fund,' and not to the reserve-fund itself; and as the company has never had any 'excess of reserve-fund,' this opinion is not applicable to their case." In reply to this I have to say that the opinion was given on inspection of the whole accounts and perusal of both the Acts of Parliament relating to the company, and it dealt with the whole question of the creation and disposal of the reserve-fund, and concluded by saying that "the company systematically *evaded* compliance with the directions of the Legislature on this subject." Mr. Hawksley explains very fully the manner in which the reserve-

fund has been handled so as to effect a *seeming* compliance with the Act of Parliament. In his report to the corporation he says: "It is obvious that the account of the reserve-fund has not been properly kept, and that the fund itself has not been properly applied; and that, in point of fact, the so-called reserve-fund account is not an account of the reserve-fund, but only of a floating cash balance remaining in the hands of the company, after numerous dispositions of the moneys of the fund had been made, otherwise than in conformity with the Acts of Parliament. Thus, by way of example, in the year 1869 the company has in form, but in form only, transferred from surplus profits to a *quasi*, but not a real reserved fund, no less a sum than £9752, and then, in like manner, has in form, but in form only, transferred from this *quasi* reserve-fund to a *quasi*, but not a real capital account, no less a sum than £6302. Moreover, the sum lastly mentioned has admittedly been expended for purposes to which capital *bonâ fide* raised by shares and loans could alone be appropriated. The accounts called the reserve-fund account and the capital account are, in truth, fictitious accounts, and have no real or legal existence. They are mere records of transactions of the company without and beyond the powers of its Acts of Parliament, entirely wrong in themselves, and eminently injurious to the interests of the consumers of gas for the time being." Mr. Margerison quotes three clauses of the Act to show that the application of the reserve-fund has been in accordance with the powers of the company, but they only give a *part* of the truth, and he very prudently suppresses all reference to section 4 of the Act of 1845, which authorized an additional capital of £60,000, in £25 shares, in these terms:—"And be it enacted, that it shall be lawful for the company to raise, by creating other new shares, any further sum of money, not exceeding in the whole the sum of £60,000 (in addition to the said original capital stock of £15,000, and the said additional capital stock of £30,000), which shares shall be sold by auction or otherwise, in lots, and subject to such conditions and stipulations as to the payment of the purchase-money and calls in respect thereof, and at such times as the company shall think fit; and that any sum of money which shall arise by such sale by way of premium shall be expended in extending or improving the works of the company, and shall not be considered as part of the capital thereof." Mr. Margerison asserts that if the company had kept on increasing their capital, dividends must have been paid on it at 10 per cent. Now, in 1851 and 1853 the company did, in conformity with their Act, raise £10,000 by sale of shares, and they realized nearly £9000 in premiums thereon. If they had raised their whole new capital of £60,000 in the same way, it would have produced at least £114,000, of which £54,000 would not have borne a farthing dividend. Thus the company would, if they had carried out the provisions of their Act, have been shut up to a dividend of little more than 5 per cent. on their new capital, and this, I think is the true explanation of the illegal course the gas company has taken.

The minutes were confirmed.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

Prize Essay

ON THE BEST METHOD OF CARBONIZING COAL:

Taking into Account Condition of Coal, Size of Retort, Weight of Charge per Retort, Duration of Charge, and whether the Mixture of Coals in Retorts is recommended or not.

By P. Inness, Gas-Works, Forfar.

The process of carbonizing coal for the production of illuminating gas is a chemical one. In order that the manufacturer in this branch of business may pursue it intelligently and with successful results, he must have well studied and familiarized himself with the nature and characteristic properties of the material he operates upon. The composition of coal, the changes which take place in it when subjected to different degrees of heat, and the numerous compounds which are formed when under that influence, are inquiries the prosecution of which cannot fail to assist him in his endeavours to obtain the highest and best results.

To the nature and properties of several, at least, of those compounds, especially those which affect the quality and purity of his gas, particular attention and study must be given, in order that he may be able, as far as lies in his power, to lessen the production of those noxious and injurious bodies which must be removed before it is fit for use, as also, on the other hand, to increase the formation and retention of those gases and vapours which give to it its luminous qualities and commercial value.

It is quite true that gas is manufactured, and that well, too, in many places where even the slightest chemical acquaintance or knowledge of its constituents, and the actions and reactions which take place throughout the whole process of manufacture, is wanting; but it must be conceded that that experience which has ultimately led to correct methods of manufacture, in many such cases, was long in being acquired, and hard won, that progress is often barred by prejudice, and improvement slow in being adopted. Operations so conducted are devoid of that pleasurable feeling which an intimate acquaintance with all the peculiarities and ramifications of the process of manufacture gives, and which stimulates to further exertions in perfecting and improving them.

Coal.—Before entering upon the subject of carbonization, it may not be deemed irrelevant to say a few words regarding coal itself, confining our remarks principally to cannel coal.

Coal, the condensed vegetation of a former era in our world's history, when analyzed, is found to consist of variable proportions of the elementary substances—carbon, hydrogen, oxygen, sulphur, and nitrogen. There is, besides, a quantity of earthy matter, which we need not consider here more than to say it is composed principally of silica, alumina, iron, and lime.

The two principal elements in the composition of coal are carbon and hydrogen. Speaking loosely, it may be considered an impure solid hydrocarbon of complex constitution. Its value as a source of heat and as a fuel depends upon the amount of carbon it contains; as a gas-yielding and illuminating agent, upon the amount of hydrogen. With the exception of sulphur, the carbon, hydrogen, oxygen, and nitrogen exist in the coal in chemical combination with each other, but in what forms we know little or nothing. Oxygen, the source of the carbonic acid, carbonic oxide, water, &c., generated during the distillation of coal, varies in amount in dry coal from 1 to 12 per cent., decreasing in amount the older the coal is in its geological aspect. Nitrogen, the source of the ammonia found in crude gas, varies from 1 to 2 per cent. Sulphur, which exists in the coal in the form of iron pyrites, seldom exceeds 2 per cent. of the coal; a few coals, however, are entirely free from it. With hydrogen it forms that noxious impurity of coal gas, sulphuretted hydrogen.

Generally, coal is analyzed proximately by ascertaining the amount of volatile matter (which includes the oxygen and nitrogen), fixed carbon, sulphur, hygrometric water, and ash it contains. The volatile matter ranges from a little above 20 per cent. in the lowest Welsh* coals to upwards of 70 per cent. in the celebrated Boghead; whilst from this volatile matter the amount of permanent gas obtained varies from 7 to 35 per cent. of the weight of the coal. As the combining proportions by weight of carbon and hydrogen are as 6 to 1, it will be easily seen how the value of coals in respect of their volatile matter is greatly increased by very small additional per centages of hydrogen, 1 per cent. of hydrogen uniting with carbon as in the formation of hydrocarbons, taking up 6 per cent. of the carbon in its lowest state of saturation with that body. Take, for example, Boghead cannel. This coal contains about 9 per cent. of hydrogen, to saturate which will require 54 per cent. of carbon, making in all 63 per cent. of volatile hydrocarbons. If we add to the above the 5 per cent. of oxygen and 1 per cent. of nitrogen which that coal contains, we make a total of 69 per cent. of volatile matter, which corresponds very closely with the results of analysts of that coal. The reason why coals yielding a high quality of gas give likewise a high quantity of gas may also be inferred from the relative combining proportions of carbon and hydrogen.

When coal is heated, whether in an open furnace, or, as in the manufacture of illuminating gas, in closed retorts, it yields up its volatile matter in the form of hydrocarbon gases and vapours, which, in the former case, are consumed as they are generated; in the latter case, are, after being separated from their impurities and condensable congeners, collected and stored up for use at will. The variable proportions in which permanent gas and condensable vapours are produced from the same coal, when distillation is conducted in close vessels or retorts, depends much on the condition in which the coal is at the time, and the temperature it is subjected to, and so also does the time occupied in exhausting it of its volatile matter. If the temperature be low, and the coal be in a damp or bulky condition, the generation of the volatile matter is slow, the production of tar and oil is increased, but the quantity of sulphur impurity is lessened. On the other hand, if the coal be well comminuted, dry, and spread thinly over a large and bright red-hot surface, the yield of gas is increased, the production of condensable bodies diminished, and the exhaustion of the coal more rapid. The other constituents of the coal—oxygen, nitrogen, and sulphur—pass off in various combinations and in variable quantities during the distillation, likewise depending on the temperature and condition of the coal. They are chiefly steam or water vapour, ammonia, carbonic acid, carbonic oxide, sulphurous acid, sulphuretted hydrogen, and other sulphur compounds. Small quantities of a number of other bodies are found in the crude gas, but as they do not come within the scope of this paper, they do not require to be taken notice of here.

Writers on the subject of the carbonization of coal, in describing the manner in which the gas is generated from it, while under the influence of heat in a retort, affirm that the elements of the coal are liberated or set free, and enter into combination again, forming vapours or gases, as the case may be, in the proportions in which the constituents of coal gas exist.* Now this may be possibly the case in some respects with the oxygen, nitrogen, and certainly with the sulphur in the coal, but we cannot see how the generation of hydrocarbons from coal can be explained on this hypothesis. Free hydrogen and free carbon require a very high temperature before they will combine, and the only product known to be formed under these circumstances is acetylene. This constituent of coal gas—which is most abundant in gas produced at high heats—is in all likelihood not formed in the above manner, but rather by the decomposition of olefiant gas when in contact with the heated surfaces of the retort. To us a more rational hypothesis is that the carbon and hydrogen, existing as they do in the coal in a chemically combined state, are eliminated from the coal, when subjected to heat, in a similar though less saturated or complicated state with each other than formerly; that these eliminated hydrocarbons, on their issuing from the coal in a vaporous condition, may by further action of the heat be drawn into vapours of a still less complex nature, until at last, by increasing temperature, they will be found in the permanently gaseous form, such as olefiant gas, &c. By still further increasing the heat, *complete* decomposition will take place, and then will the carbon and hydrogen be set free or liberated.

Let any one take up a book on chemistry, and examine the constitution of the hydrocarbon compounds, he will find a multitude of these bodies in the solid, liquid, and gaseous state. He will find that, generally speaking, the number of aggregated atoms of carbon and hydrogen is highest in the solids, that they decrease as they come down to the liquids, still further as they approach the gases, until we find that the most permanent gases are those which have the least number of atoms of carbon and hydrogen in chemical union. Acetylene, for example, the most stable of all the constituents of coal gas, is composed—according to the newest notation—of only one equivalent of carbon and one of hydrogen. Now if we heat any of the higher compounds of the above elements, they resolve into other compounds less complex in their nature, according to the temperature, but the elements of the body are not set at liberty to enter again into combination to form the resulting compounds. By molecular rearrangement, when under the influence of heat, they divide themselves, as it were, into a greater number of, but smaller, companies; but, unless by intense heat, they are never entirely separated. Subject the vapours eliminated from a piece of coal to an ever increasing temperature, and they will all pass through the gradations implied above, to permanency, and, at last, to complete decomposition.

On the supposition that coal is an impure solid hydrocarbon, the generation of the various vapours and gases from it appears more explicable. As, during the exhaustion of the coal in a retort, no two parts of it in depth, we may almost say, are at the same temperature, the vapours which are eliminated will be various in kind as in their degrees of saturation. Those formed near the surface of the retort will be of a nature approaching to permanent gas, and, if the heat on the retort be very intense, decomposition, to a certain extent, will take place there, setting the carbon and hydrogen free; while those formed on the upper layer of coal will, perhaps, be as far the other way, and, if not retained and subjected to a higher temperature, will be subsequently condensed into the liquid, perhaps solid, state. From the preceding remarks we would infer that, by superheating the vapours as they are evolved from the coal, either by passing them through another retort, or, by a continuation of the same retort, at a temperature, say, less than that which would decompose olefiant gas, a considerably greater proportion of permanent gas would be obtained than is had from the present system of manufacture.

With these preliminary observations on the behaviour of coal when under the influence of heat, it is time that we now enter a little more minutely into the details of carbonization, special attention requiring to be directed to "the condition of the coal, weight and time of the charge," &c., taking it for granted that by the phrase, "the condition of the coal," is meant its condition as to moisture, and the manner in which it is broken when put into the retorts.

Condition of the Coal in regard to its Water.—It is a matter we may almost say of universal experience among gas manufacturers that water or its vapour is prejudicial to the production of gas, both as regards quantity and quality. We have, therefore, merely to explain why this is so. In distilling coal we have water from two sources—hygrometric water, and water from the union of the oxygen and hydrogen of the coal. The hygrometric water is expelled from the coal at the temperature of 212° Fahr.; the other water is evolved at about 600° or 700° Fahr., when molecular disturbance begins to take place in the coal, the oxyhydrogen compound, in whatever state it exists in the coal, evidently resolving itself into a water combination.

In the conversion of water into steam or vapour, a considerable amount of heat is absorbed; its tendency, therefore, in being expelled from the coal immediately after the retort has been charged, is to reduce the temperature of bodies in contact with it, robbing the retort of a considerable portion, as also the vapours which are simultaneously being evolved from the coal, and thereby increasing the amount of condensable bodies. As the time occupied in driving off the water vapour depends upon the weight of the charge and the thickness of the stratum of coal in the retort, this deteriorating effect will vary also. Its effect, however, is best exhibited during the first hour of the distillation, when comparing the quantity of gas obtained from a charge of well-dried coal with that obtained from an equal amount of damp coal. It will be seen that in the latter case the volume of gas will be considerably diminished, not so much in being sluggish in coming off as by the reduced temperature of retort and coals causing the conden-

* Some anthracite coals contain over 90 per cent. of carbon, consequently the amount of hydrogen they contain must be very small.

* So Mr. Clegg affirms, in describing his web retort; and such appears to be the opinion in general, as far as the writer has been able to learn.

sation of what would have been rendered permanently gaseous had the coal been in a dry state. The gas lost by condensation during the time the water is being expell d, and the reduction in temperature of the retort, diminish the quality of the total production of gas off the charge. Also, not only will the yield of gas per ton be greater in dried coal, but the time occupied in exhausting it of its volatile matter will be considerably shortened. Damp coals, when put into retorts in charges of the ordinary weight, are rarely exhausted when the time arrives for drawing, and the heat on the retort is so much let down that the subsequent charge must be considerably lessened in weight. It is obvious, therefore, that if, through necessity, damp coals are put into retorts, the weight of charge ought to be much reduced, and the coal spread thinner on the surface of the retort, in order that the water may be driven off as rapidly as possible, and not interfere with the subsequent generation of the gaseous constituents.

Where gas is manufactured at a high heat, as in Scotland generally, a considerable portion of the water vapour, evolved from the coal at the further end of the retort, is decomposed by contact with the intensely heated inner surface of the retort, resolving it into its constituents—oxygen and hydrogen; the oxygen forming with the carbon on the walls of the retort carbonic oxide or carbonic acid; and with sulphur, sulphurous acid. The hydrogen being at too high a temperature to exist in combination with carbon, passes off in the free state.

In whatever way we look at the action which takes place by the increase of moisture in coal, it does not in any way add to the quantity or illuminating properties of our gas; but, on the other hand, it increases the amount of dilution of the richer constituents, and diminishes the yield of gas by the condensation of a large proportion of the hydrocarbons which are evolved during the earlier and most valuable stages of the distillation.

The Breaking of the Coal.—If we take a lump of coal and put it into our kitchen or parlour fire—assuming that it is in a bright red or heating state—we find that it gives out its gaseous matter in the form of flame, very slowly and limited in quantity. By-and-by it stops, as the heat is not able to penetrate much beyond the surface; but by turning it now and then we get more and more of the vapours out of the coal. After obtaining all the gas or flame we can, if we break it up, should it not do so itself, we expose fresh surfaces to the action of the heat, and a further supply of flame is produced. To take all the volatile matter out of the coal in this way is a tedious process. If, however, before putting our lump of coal on the fire, we break it up into small pieces, and spread it over the fire in a thin layer, we find that the gas or flame is rapidly and abundantly produced, and the entire exhaustion of the coal short in duration, leaving as before a bright red surface. Our illustration affords a close analogy to the production of gas in retorts, the difference being that we do not burn our vapours and gases on their elimination from the coal, but purify and collect them to give light when required; also, in a fire, *all* the volatile matter of the coal is consumed, yielding light and heat, whereas, when distilled in retorts, only a portion of that matter is obtained in the gaseous state, the remaining portion condensing into other products.

How, then, should we prepare our coal before putting it into our retorts? If we put it in in large pieces, we prevent the heat from permeating the coal fast enough, and consequently we prevent the rapid evolution of the gases. The exhaustion of the coal is also prolonged, or we are forced to use more fuel to drive it out, causing a higher heat on the retort, and possibly deterioration by that high heat, than what is actually necessary. Very little reflection is required to see that the most effective way to work the coal is to break it into small pieces, and to spread it in a thin layer over the surface of the retort. Coal treated in this way does not require so strong a heat on the retort as is usually the case where, with the aid of tar, high heats are required to expel the volatile matter from it when distilled in large pieces. As much gas can be taken out of any coal, and of as good a quality, if not superior, at a moderate temperature, when the charge of coal is well broken, and thereby spread over the surface of the retort, as when it is put in in large pieces, and distilled at the fierce heats which are practised in many works by the agency of tar. It is also often the case that, when working under these high heats, one or more retorts in the oven will have exhausted its charge of coal a considerable time before the others, unsuspected by the working of the others; the consequence of which will be that, by the time usually occupied in the distillation, a considerable amount of sulphur impurity and free hydrogen will be carried over, deteriorating what has already been produced.

Distillation, having reference to Size of Retort, Weight and Duration of Charge.—On the size and shape of retort, with its weight and time of charge, hinges, we believe, the whole question of the economic distillation of coal for producing the maximum amount of gas in regard to quantity and quality. The information we have already obtained regarding the nature of coal, and the action of heat upon it in closed vessels or retorts, will help us in succeeding remarks. Our presumed knowledge of the constituents of coal gas before and after purification informs us what we desire, and what we wish to avoid. These are—

I.—To obtain as much as possible of the permanent gaseous hydrocarbons of the illuminating order introduced into our gas, with no more free hydrogen in it than is suitable for retaining in solution similar bodies of a more unstable, but higher illuminating nature.

II.—To lessen the production of injurious compounds, such as carbonic acid and the sulphur compounds.

And to obtain the above we hold that—

1. The coal ought to be dry.

2. And broken as small as is consistent with its use as fuel and as an article of sale.

3. That the weight of the charge of coal should never exceed that amount which the supply of heat from the furnace, transmitted through the retort to the coal, is not only able to evolve vapours and gases from, but to bring as large a proportion as possible of those vapours and gases up to a temperature which will render them permanent before leaving the retort; or what may be given differently, that the weight of the charge of coal should not be such that the heat which it draws from the retort be greater than the furnace can supply the retort; in other words, the temperature of the retort should be uniform throughout the distillation.

In previous remarks we have said sufficient to demonstrate the force of our first and second opinions, and our third leads us to ascertain what happens when a retort is charged with more than its proper quantity of coal.

To bring any body into the vaporous or gaseous state requires a considerable amount of heat, particularly of that kind called latent. Witness, for example, the formation of steam from water, absorbing over five times the amount required to bring it from ordinary temperature to the boiling-point, while still indicating only the temperature of boiling water. As with steam, so is it with the vapours evolved during carbonization; if they cannot get a sufficient supply of heat to bring them into the state we want them, they, like steam, when removed from its influence, become condensable bodies. But gases and vapours are very absorptive of heat in their formation, and in their endeavours to reach a higher or more gaseous state, they, in the present instance, take more from the retort than it gets from the furnace. What follows? The temperature of the retort being reduced, a diminution in the quantity and an increase in the density of the vapours evolved ensues; the permanent gas is decidedly—we may say, markedly reduced in quantity, and unless by a skilful manipulation of, and close attention given to the fires, the volatile matter will not be all extracted from the coal at the regular time for drawing the charge. During the earlier stage of the operation, when the evolution of vapours from the coal begins to diminish in quantity, the retort, having less heat to supply, begins to gain in temperature, and generation of permanent gas is more abundant. The increase of temperature in the retort is imparted to the coal, speedily ridding it of its volatile matter, which is being evolved at an increasing temperature likewise; the last portions of it, from the high temperature the coal is now in, being marsh gas and free hydrogen principally. The ordinary experience of heavy charges is a reduction of the temperature of the retort, which it is not able to overcome throughout the whole time of the charge, resulting in a loss of gas from the increase in the amount of condensable bodies, and the non-exhaustion of the coal when withdrawn from the retort.

The time in which the distillation or carbonization of coal for producing gas is expected to be accomplished is, in Scotland, and with cannel coal, generally four hours; and it is considered that a retort which will in four hours exhaust a given weight of coal of its volatile matter, the coke or residue left in the retort being of a bright red colour, without any flame emitting from it after admission of air, that that weight of coal is the proper charge for such a retort, whatever kind it may be, and for the temperature it has been worked at. In our opinion and experience there could not be a greater fallacy. Even assuming that the heat has been sufficient in quantity to prevent the retort from being reduced in temperature, we venture to affirm that a given weight of coal can be exhausted of its *volatile matter* in three hours or four hours, as the case may be, and yet not economically distilled. We have seen in our own experience charges of 3 cwts. of coal completely exhausted in three hours, and of 3½ cwts. in four hours, but the quantity of gas produced in the first hour often did not exceed one-half of that produced in the second hour. To carbonize coal, and to carbonize it in a way that will produce the greatest amount of gas, are two different subjects. A kind of emulation appears to exist among gas managers—creditable in one sense but mistaken in its results—as to the carbonizing power of their retorts, displayed in the high quantity of coal they will, to use the technical phrase, "take off" in the ordinary time, and the quantity of gas that can be made in the "shift," without taking into consideration, in the former case, the quantity of gas made per ton, and, in the latter case, the amount of coal it has taken to produce that quantity manufactured during the "shift." It would be well, therefore, before saying too much of the carbonizing ability of our retorts, to compare the quantities of gas obtained from different weights of charge, reduced to the amount per ton of coal. In order to find out the most economical weight of charge, we must make a number of trials with charges of coal from the highest amount they will carbonize down to, say, one-half of that; noting the total quantities of gas produced, and the quantities produced per hour or half hour of the distillation. When we find that amount of coal which in the first hour yields the highest proportion per hour of the total gas made during the time occupied in working off the volatile matter, we may expect that we have found out the most profitable weight of charge for the temperature we have been working at, the size of the retort, and the time occupied in the operation.

The temperature remaining the same, every size and shape of retort has its own specific weight of charge, that it will work off profitably in any given time, and it is a matter of the first importance to have that ascertained. A 12-inch D retort 8 feet long will work off very economically 1 cwt. of coal in four hours, with a moderate heat; but 1½ cwt. can also be exhausted at the same temperature, in the same retort, but less gas per ton will be produced. The reason is obvious. In the former case the hydrocarbons are evolved from the coal at a temperature, and at a rate which gives them, or a large proportion of them, time to be heated up to permanency before leaving the retort; while in the latter case, from the increased quantity of coal giving a half more vapours evolving almost in the same time, they emerge from the coal at a lower temperature, and are expelled from the retort in a comparatively cold or condensable condition, and it is not until the generation of the gases or vapours proceeds at a rate something like what went on in the former case that the retort does its work satisfactorily.

But let us spread our 1½ cwt. in an 18-inch retort, and we find a difference; we have now a heating surface corresponding to the 1 cwt. of coal in the 12-inch retort; but still further, if we use a 24-inch retort, with the 1½ cwt. of coal, our results are still more decided. We have now double the heating surface below the coal, and, if broken in the manner we have previously expressed, the stratum of coal is only one-half in thickness which existed in the 12-inch retort; any given area of it, will therefore perform its work in half the time it did in the 12-inch, and two results will follow—first, a large proportion of the hydrocarbons, owing to the more rapid action of the heat upon the coal, or rather through the coal, will be evolved in a state of combination approximating that of olefiant and other illuminating gases, consequently a greater amount of permanent gas will be obtained; and, secondly, the time occupied in exhausting the coal will be considerably shortened—instead of four hours, as in the 12-inch retort, 2½ or 3 hours at the most will suffice.

We might go still further in increasing the size of the retort, with increased results as to time of carbonization and quantity of gas; but as the size of the retorts or heating surface is increased, the weight of charge being the same as formerly, the coal will require to be still further broken, so as to spread over the increased area of heating surface. The evolution of the gases will be proportionately increased, the time occupied in the evolution will be proportionately diminished, and, as the temperature of the gases and vapours, on their elimination from the coal, increases as the thickness of it on the surface of the retort diminishes, a point will be reached where no superheating of the vapours will be required, but, on the contrary, means must be adopted for their rapid withdrawal from the retort, or complete decomposition, to a considerable extent, will take place. We must increase the diameter of our ascension-pipes, lessen the hydraulic dip, or use the exhauster. There is, therefore, a limit to reducing the thickness of the stratum of coal on the surface of the retort in small works where the exhauster is not used.

Opinions are varied among gas managers as to the merits or demerits of the different kinds of retorts. Some uphold in their practice round retorts entirely; others round and elliptical; while others, again—and these, we think, in the majority—incline to the D shape. The round retort, from its shape, is certainly the strongest, but the irregularity of the stratum of coal, which increases with the diameter, is an objection. The elliptical is rather better in this particular, while the D, theoretically and practically, appears to us the best. If D retorts were made slightly convex on the inner surface of the bottom, it would help to mitigate the accumulation of carbon on the flanks, which soon renders the 15 or 18-inch D practically elliptical. Best of all are, if they can be got into the oven at all, good wide retorts from 20 to 27 or more inches wide. They take no more fuel to work them, and, with ordinary temperatures, they will work off charges common to the 15 or 18 inch D retort more efficiently, quicker, and, from their lower temperature, with less impurity of the sulphur kind. The coal being broken and spread over the surface of the retort, as previously mentioned, the end of the distillation is more marked and decided, owing to the uniformity with which the coal is acted on by the heat.

As with the shape, so are opinions regarding the length of retorts. From want of room with some, and from a desire to increase the production of each oven with others, long retorts, 8½ to 10 feet, are used. Where space is no object, others incline to medium length of 8 feet, preferring to give it width.

Where high heats are used, long retorts are objectionable on account of the distance the vapours evolved at the farther end of the retort have to travel under the intensely heated roof of the retort. This deteriorating effect is at its worst during the second and third hours of the charge, when the vapours are being evolved at an already high temperature, and less in quantity, consequently not so quickly expelled from the retort. If space permitted in the retort-house, retorts 9 feet long would be better made 10 or 11 feet long, with an additional mouthpiece and ascension-pipe, and charged at each end alternately. Under high heats we are impressed that retorts 8 feet long are sufficient in extent, unless where necessity compels it to be otherwise. Some settings of retorts heat most at the front; others, and preferably so, at the back, decreasing slightly

towards the front. Wherever they heat most, there the coal ought to be spread thicker, in order that exhaustion may be effected uniformly throughout the retort.

Impurities.—The principal impurities in coal gas are ammonia, carbonic acid, and the sulphur compounds; the diluting gases are carbonic oxide, marsh gas, and an excess of free hydrogen.

Ammonia, a compound of nitrogen and hydrogen, cannot be formed by direct union of these elements, it therefore is eliminated from the coal as such. It comes off, as far as we are aware, during the early stages of the distillation. It is not altogether an impurity which we wish to diminish, as it is a valuable secondary product.

Carbonic acid is produced principally at a high temperature, and therefore in most abundance during the latter part of the process. It is also formed by the partial combustion which takes place for some time after the retort has been charged by the admission of air during that process; likewise by the decomposition of the water on the carbonaceous crust of the retort, if not at too great a temperature. If otherwise, as is oftenest the case, carbonic oxide is the result.

Sulphur does not, like the components of the preceding gases, exist in chemical union with the carbon and hydrogen, but as an impurity in the coal, in the form of iron pyrites, or, chemically speaking, the bisulphuret or desulphide of iron. It has, therefore, to be decomposed before it can enter into combination with free hydrogen. It takes a good heat to decompose the pyrites, as well as a good heat to make the sulphur unite with hydrogen, and, as both of these bodies are limited in quantity during the early part of the carbonization, hence the cause of so much of that impurity—sulphuretted hydrogen—being formed during the latter stages of the process, when, from the high heat in the coal at that time, both elements are abundant. At this time, also, is formed that noxious compound of sulphur with carbon in the incandescent state—the bisulphide of carbon.

It appears from the preceding remarks that, as the bulk of the deleterious compounds and diluting gases are formed when the coal is about exhausted of its hydrocarbon, it would be better to dispense with the latter part of the distillation altogether. What is to be chiefly sought after in avoiding these impurities are—exhaustion of the coal ceasing uniformly throughout the retort, and that the charge for whatever time it may be should not be worked off any considerable interval before the usual time of "drawing," but cease as near as possible at that time. In long-time charges, from the irregularity in the temperature of the retort caused by a greater thickness of the coal in the retort, and the want of the same attention to the fires as is necessary in short-time charges, the exhaustion of the coal is subject to much irregularity. In a wide retort, with its other advantages, in short-time charges the thinness of the layer of coal, and the greater heating surface on the bottom of the retort, has little effect on its temperature, and when the charge is regularly weighed out (as must be the case to make short-time charges successful), the time of the end of the distillation can be more relied on, and from the greater attention given to the fires a charge of coal can be adopted which will be worked off almost exactly at the time of "drawing." Hence, by the adoption of wide retorts with short-time charges, the sulphur to a considerable extent can be retained in the coke. In a long narrow retort, with a heavy charge of coal, as soon as the layer next the bottom of the retort is exhausted it becomes a new heating surface to the upper coal, with this difference—that, besides heating the coal above, it is itself most active in yielding its impurities, while the upper part of the coal is yielding its luminous compounds. This is, to a certain extent, the case in all retorts, large or small, but it diminishes with the depth of coal, and consequently will be least in a large retort with small broken coal.

To diminish the impurity we must either work at a lower temperature or with a smaller charge; the more the weight of the charge is reduced within certain limits, the better will be the desired results. But when we diminish the quantity of coal per charge we diminish the production of our retorts, although the yield per ton be greater. If we must produce the same quantity of gas, we are forced then to a wider or longer retort, in which, by a more rapid and uniform exhaustion of the coal in shorter periods of time, as has been expressed above, the formation of the sulphur and other impurities is considerably checked.

We think that we have now said sufficient to show that economic distillation or carbonization of coal is more effectively attained in wide retorts, with small short-time charges, than in small narrow retorts, worked as they generally are, with respect to quantity, quality, and minimum freedom from impurity. Before leaving this part of the subject, we may briefly recapitulate the views entertained by the writer, as has been attempted to be demonstrated in the foregoing:—

1. That to produce permanent illuminating gases from coal a certain temperature is required to be given to the vapours evolved from the coal. If they are heated much above that temperature, they are mostly destroyed; if they do not attain that temperature, they are condensed.

2. By the present system of manufacturing gas, from a half to two-thirds of the hydrocarbons eliminated from the coal are lost by condensation, the reason being plainly they have not reached the temperature mentioned above.

3. That to generate hydrocarbons in small retorts, unless the charge of coal is *very small*, is to increase the proportion of condensable bodies. The size of the retort, with the rate at which the vapours are evolved and expelled from the retort, especially during the earlier and richer period of the distillation, is insufficient to supply that amount of heat which is necessary to bring anything like a due proportion of the vapours to the gaseous state.

4. That by a more rapid action of the heat through the coal the vapours will be eliminated from the coal at a higher temperature, more approximating that of permanent illuminating gas; hence a greater proportion of that kind of gas will be obtained.

5. That, other things remaining the same, this more rapid action of the heat through the coal can only be obtained by a greater heating surface and a finer division of the coal.

6. That a greater heating surface and a finer division of the coal implies a process shorter in its duration than ordinary.

7. The bulk of the impurities—ammonia excepted—appear to be produced in greatest abundance when the coal is about exhausted of its hydrocarbons.

8. That from the uniformity with which distillation is carried on in a wide retort at a moderate and regular heat, and with a thinly spread layer of coal, distillation is completed earlier and more suddenly, giving better notice when the charge can be drawn than is the case in a small retort having much irregularity in the depth of coal throughout it, in one part exhausted of its hydrocarbons, and active in giving out its sulphurous compounds, while other parts are busy yielding their luminous compounds. In short, it is our opinion, from the nature and properties of coal itself, that distillation of it for producing the highest results, both as to quantity and quality of illuminating gas, is best obtained in wide D retorts, from 20 to 27 or more inches, and about 8 feet long, worked at a moderate heat with a charge of coal which will evolve vapours from it at a temperature as near as possible to that of permanent illuminating gas; yielding quantities of this gas in proportions decreasing as the time of the charge increases, or, in other words, yielding the greatest amount of gas per hour in the first hour, considerably less in the second hour, and ceasing entirely at the end of the third year.

We mentioned before that a 12-inch D retort will work off very [illegible] economically, at a fair heat, 1 cwt. of coal in four hours. Were we to spread [illegible] it out in a 24-inch retort, naturally we should expect it worked off in two hou[illegible]rs; it will, however, work off in an hour and a half, perhaps less. By a very slight increase in the temperature 2 cwts. of coal will be worked off easily in three hours in a 24-inch retort, and this is the weight of charge which we [illegible]hould adopt in such a retort in such a time, making ample allowance for dampness of the ordinary kind, working at a fair heat, and the coal well broken. The quantity for any other size of retort may be inferred.

The weight of charge and duration of it is a thing which must be, in a great measure, left to the manager's own experience and discretion. In smaller works a number of circumstances conspire against short-time charges, such as a want of steady work for the retorts, the diversity of the firemen's duties, and the greater alternations in the "heats" arising from a want of the same attention as is necessary in short-time charges. We are impressed, however, that in large works, where everything is expected to be carried out methodically, and where subdivision of labour is the rule, weighed three-hour charges of coal would be found to be more profitable than four-hour charges.

Mixing of Coals.—It has been an established fact for a considerable time, that, if we put a proportionate mixture of coals, yielding different qualities of gas, into a retort, we shall get a higher quality of gas than if we had mixed the gases, distilled separately from these coals, in the same proportions. The cause of this phenomenon is explained in several ways, for which see a paper by Dr. S. Macadam, in the JOURNAL OF GAS LIGHTING for Jan. 4, 1870. Our opinion is simply that that portion of the vapours of the inferior coal, which are completely decomposed when distilled alone, are, to a considerable extent, protected by the denser vapours of the richer coal. This may be better shown by an illustration. Olefiant gas, when subjected to a red heat, is decomposed into marsh gas and free carbon, or marsh gas, acetylene, free hydrogen, and free carbon, according to the intensity of the heat. But not to complicate matters, let us say that the gas from a charge of inferior coal has 300 volumes of olefiant gas completely decomposed by contact with the hot retort, resulting in 600 volumes of free hydrogen. If we mix a third part of the charge of inferior coal with two-thirds of a considerably richer coal, less than 100 volumes of olefiant gas of the inferior coal will be decomposed, because that quantity of gas which was formerly decomposed is now nestled among or distributed through the vapours and gases of the richer coal. To keep to the proportion, let us say there are about 30 volumes of olefiant gas decomposed, yielding 60 volumes of hydrogen. It is clear that we have a gain of about 70 volumes of a luminous hydrocarbon, and less of the diluent hydrogen; and, consequently, a higher result in regard to quality will ensue from the mixed distillation than by the proportionate mixture of the gases distilled separately. It may be said, however, that what is gained from the inferior coal will be lost by an equivalent amount of decomposition of the gases of the richer coal. But no; the gases and vapours of the richer coal, from being denser in their nature, can stand a greater amount of superheating before decomposition than those of the inferior coal, and the very fact of them being less in quantity in the mixed charge, leads us to believe that a greater proportion of the gases and vapours of the richer coal will be rendered permanent than in the case where the charge is wholly of the finer coal. The total result of the mixed distillation, on the above explanation, will be an increase in quantity and quality of the gas. What may also assist is, that the greater proportion of marsh gas and free hydrogen which exists in the inferior coal will be able to take up in solution a quantity of those volatile and unstable hydrocarbons which the richer coals are so abundant in.

It has also been explained by the reaction of the hydrocarbon gases and vapours upon one another when in the nascent state. The property of chemical combination in the nascent state is one which belongs more to elementary gases and vapours—as oxygen, hydrogen, chlorine, &c., or of an elementary gas upon a compound body, as in the decolorizing property of oxygen in the ordinary process of bleaching through the agency of chlorine—than to compound gases and vapours. We are somewhat sceptical as to any chemical combinative action of compound bodies, such as hydrocarbons, upon one another in the nascent state; besides, the action of heat in eliminating hydrocarbons from coal is not in its nature combinative but separative. It is a splitting up of the denser or more complex bodies into compounds of a simpler form.

The practicability, in large works, of mixing coals is doubtful; we are afraid that the quality of the gas could not be maintained with uniformity. In small works, however, no difficulty occurs in adopting the scheme, the writer having practised it constantly, and observed its beneficial results.

In concluding these remarks upon the carbonization of coal, we desire it to be noticed that they have been considered only with reference to cannel coal. The conditions under which bituminous or caking coals are distilled, in reference to time of charge, are quite different from those of cannel. In cannel, the vapours are evolved from it freely, and, from the rapidity and abundance with which, at first, they come out, their temperature, compared with after stages of the process, is low, and they require, to a certain extent, to be further heated before leaving the retort. Bituminous or caking coal fuses, and, unless where it lies thin on the surface, runs together, and forms, as it were, a mass of whole coal, with all the disadvantages of distillation in that state, as formerly mentioned. The vapours on the surface come away readily enough, but those formed in the interior are, from the plastic and cohesive state the coal is now in, imprisoned for some time; the coal swells up by the expansion of those vapours and gases within, until at last they overcome the cohesive force, and burst through it. Hence the longer time in exhausting the charge than with cannel. It can be also seen how the gases are so impoverished with such a large proportion of free hydrogen, for, before they can force their way out of the coal, they are heated up almost to the point of complete decomposition, and are sure to be so decomposed if they come in contact with the hot retort. It is here that the exhauster is an instrument of great value.

METROPOLITAN BOARD OF WORKS.

The First Meeting of the Board since the recess was held at the Office, Spring Gardens, on Friday, Sept. 23—Alderman GIBBON in the chair.

The CLERK (Mr. Pollard) made a formal announcement of the death of Sir John Thwaites, the late chairman, which took place on the 8th of August last. He also read a letter from the Home Secretary, dated the following day, in which it was suggested that the appointment of a new chairman should be made subject to any change affecting the position of the future chairman which legislation on the local government of the metropolis may render necessary.

On the motion of Mr. RUNTZ, seconded by Mr. LE BRETON, a resolution was then adopted, expressive of the respect and esteem in which the late Sir John Thwaites was held by his colleagues, their sense of the great loss which the metropolis at large has sustained by his death, and offering to Lady Thwaites and the members of her family the sincere and heartfelt condolence of every member of the board. It was further resolved that a copy of this resolution should be engrossed on vellum, sealed with the seal of the board, and presented to Lady Thwaites.

The clerk laid before the board a communication from the Strand District Board, submitting that the election of a successor to the late chairman, from gentlemen not members of the board, would be a discredit to local government.

A letter was also read from the vestry of St. Anne, Westminster, expressing a hope that, in appointing a chairman, the board would (in the interest of local self-government) appoint one of its own members.

Addresses of condolence on the death of Sir John Thwaites were presented from the following vestries and district boards—viz.: Bermondsey, Lambeth, Marylebone, Mile-End Old Town, Newington, Plumstead, St. Saviour's, Southwark, Wandsworth, and Woolwich; also from Lord John Manners, formerly Her Majesty's First Commissioner of Works.

On the motion of Mr. NEWTON, seconded by Mr. COLLINSON, it was then resolved to refer the consideration of all questions relative to the appointment, duties, and salary of the chairman, to a committee of the whole board.

PRIZE ESSAY

ON THE BEST MODE OF CONSTRUCTING AND SETTING A BENCH OF FIRE-CLAY RETORTS.

By A. MACPHERSON, Gas-Works, Kirkcaldy.

The proper construction of the ovens, the size, form, and thickness of the retorts, and method of setting the same, form a most important part in the gas engineer's plans, when he is called on to construct a new or reconstruct an old work.

It is here we must look for economy, as, unless proper attention is paid to the construction of the ovens, setting of retorts, &c., there is almost sure to be a great loss. In constructing a bench of retorts, it is necessary to consider how the space at your disposal can be most economically laid out, so as to secure as large a productive power as possible, and, of course, at the same time having a due regard to efficiency. It has been proved by experience that where sufficient attention has not been paid to this matter in the construction of a work, it is cheapest in the end to at once remove the defective part, and replace it on a better principle; the chief objects in the construction being to obtain a sufficient heat for carbonisation, and that at as small a cost for fuel as possible, and the greatest amount of productive power from a limited space.

In selecting a site for a retort-house, care should be taken to ascertain that the ground is free from standing or running water, as, should water be under the retort-bench, it has a tendency to absorb the heat from the setting, and thus cause a low temperature, and a larger quantity of fuel will be required to maintain the retorts at the proper degree.

The securing of a good firm foundation for the brickwork of the bench is necessary for the stability and durability of the work. I have known instances where this was neglected, and the result was, as might have been expected, the side or division walls sank, the arches followed, and, throwing the stress on the retorts, they in their turn have yielded to the pressure thus thrown upon them, and broken through, thus rendering necessary their removal, when comparatively little damaged by their use as productive vessels. It is, therefore, necessary to have a good, firm, and equal foundation, either artificial or natural, over which to rear the brickwork. The lower portion of this may consist of concrete, common composition, or old fire-bricks, well bedded and grouted with lime, up to the surface of the ground or level of floor; the spent lime of the purifiers will be found very useful and efficient for this purpose. From the level of the floor to, say, one course over arch, the bricks, where exposed to the direct action of the heat, should be of the best fire-clay, bedded in fine clay, and set as hard to each other as possible, so as not to leave large or open joints. Over the arch the brickwork should be made as firm and solid as possible, to prevent the passage of the heat through it, and consequent radiation into the air; also, to guard against cold air gaining admittance, which would cause a loss of heat and draught. Special attention should be directed to this point, so that no unnecessary opening may be left. A coating of fine sand on the top of the bench has a good effect in preventing the passage and radiation of the heat.

In forming the arches a good firm springing should be obtained, they being of the form known as the barrel arch, which I am inclined to think is the form best adapted for this purpose. I would also recommend two 4½-inch rings, in preference to one ring of large-sized bricks, as the former will render it more secure; and should the under one give way from bad materials or workmanship, or any other cause, the upper one will still remain, and enable the manager to work out the retorts before repairing the damage.

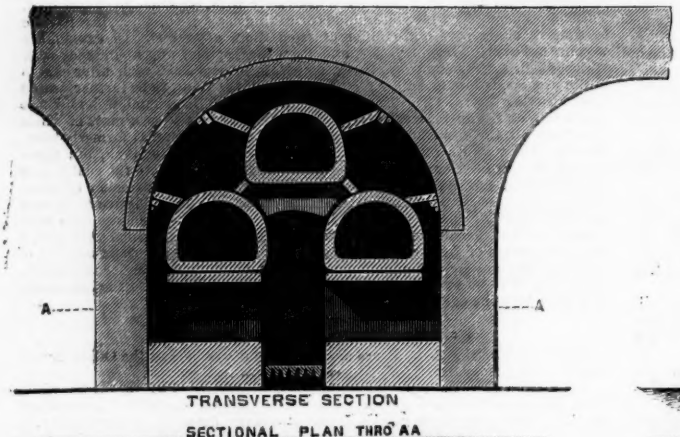
The next thing that demands the attention of the engineer, after the construction of the bench, is the retorts—their form, size, thickness, and manner of setting; and the success of the work will greatly depend on how this is executed, as, if defective at this part, it can never be profitably carried on, as it is on this we depend for the proper production of the gas; and it may be styled the fountain head.

The retorts should be carefully made of the best clay, mixed with a proper proportion of previously burned clay, or other suitable substance, so as to render them porous enough to fire without cracking, &c., as, should they have small cracks in them, there is considerable loss by leakage. The form of retort best suited for the carbonization of coal is that generally known as the D retort, it being preferable to the other forms for the following reasons:—The ear-shaped retort, although undoubtedly the best form, has also its objections, for while it has the advantage of exposing a large amount of heated surface to the coal, in practice it has been found difficult to get an equal layer of coal, owing to the depression at the edges, the layer being generally thickest there, and at top of circle of bottom comparatively thin; the sides are also in a short time found to fill up with carbon, and it is then actually of the D form, and it is better to set retorts of the D form at first, than to have them converted into it by having a layer of non-conducting material interposed between the retort and the coal. The objection to the round and oval form of retort being the reverse of that to the ear-shaped, the layer of coal being in this case thickest in the centre. And this is an objection that should not be overlooked, as it is of great importance to have a thin and equal layer instead of a compact mass. When the gas is being generated from retorts of this form, at that period when the outside of the mass has reached a high temperature, the gas evolved from the coal surrounded by this body of highly heated coke, and having to pass through and over it, is apt to be decomposed, and a portion of carbon deposited, and the gas is thus deprived of a portion of that constituent it is of so much importance to retain. A longer time is also required for the heat to penetrate the mass than a thin layer, and hence a loss of time and fuel, which does not happen when the flat surface of the D is employed; a flat surface and a thin equal layer of coal being, in my opinion, the most economical.

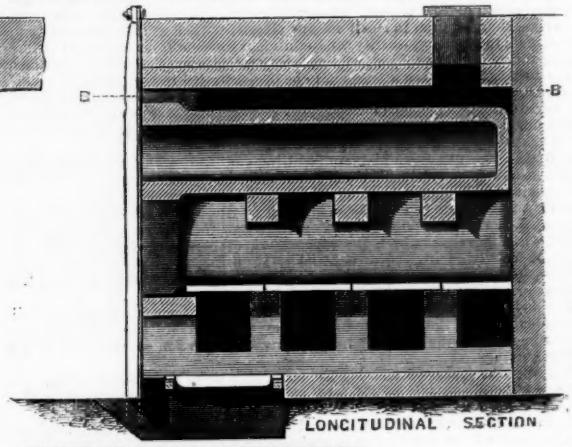
There is as great a difference in the size as in the form of retorts, and this also requires consideration. It is now, I believe, pretty generally admitted that a small clay retort cannot be so profitably employed as one of a fair average size, as it requires more fuel and labour to produce the same quantity of gas from a small-sized retort than from a large one; it is, therefore, necessary to select retorts of such a size as will most effectually carbonize the coal, and at the same time be easily worked, a fair workable size being 20 by 14 inches by 7 feet 6 inches or 8 feet long. In large establishments, and more especially in England, long retorts, open at both ends, are sometimes used, but this is seldom resorted to in Scotland.

A difference of opinion also prevails as to the proper thickness of retorts. Some prefer thick ones, while others are more favourable to those of a medium thickness. It is a general impression that thick ones last longer than those a little thinner. Although this may be the case, I am not at all sure that this is the proper manner to consider the matter, as it is much more difficult to bring the former up to and sustain them at the required temperature than where the latter are used. And thus the deficiency in duration is more than made up by the saving in fuel, and greater amount of gas produced. Besides, in heating and cooling, I am of opinion the thin one is not so liable to crack and get injured, fire-clay being a very bad conductor of heat; if rapidly heated or cooled, it is apt to crack, and thin retorts are not so easily destroyed in this manner by the change in temperature, as it does not require so long a time for the heat to penetrate them nor to leave them, the rupture being generally caused (if in heating) by the heat causing the unequal expansion of the retort, the outside being most exposed to such influence, and expanding more rapidly than the inside, owing to the bad conduction of the heat through it, and *vice versâ* (if in cooling), the outside contracting quicker than the inside. I consider three inches to be quite sufficient for all practical purposes.

The methods of constructing the furnaces and arranging the flues are numerous, and vary very much; the principle, however, aimed at by all being to secure the greatest amount of benefit from the fuel employed, and an equal degree of temperature over the whole setting. In some arrangements the heat is made to pass over, and then under, the retorts, and thence to the main flue; it is, however, preferable to cause it to pass under first, as it is the bottom of the retort where most heat is required. It is here the coal is drawing the heat out, and although the top is doing its proportion of the work by radiation, &c., still the most of the work is performed where the coal is in actual contact with the retort, and the law of conduction is being exercised; and it is, of course, necessary to apply the most heat to that part, so as to facilitate as much as possible the carbonization. In the accompanying sketch the heat is made to pass under the retorts and along the sides, then forward along the top of the low ones, then back over the top of the upper one. And although I do not say that this is positively the best method of setting, still I have found it work very well, and the

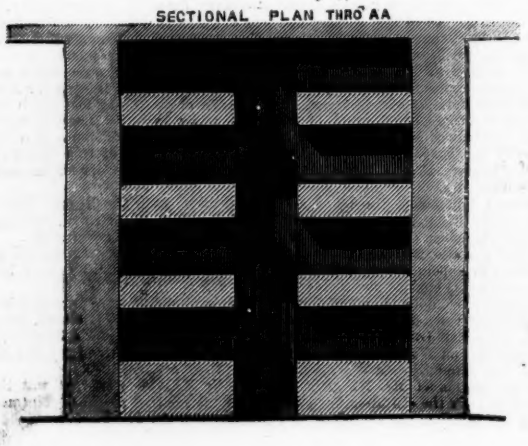


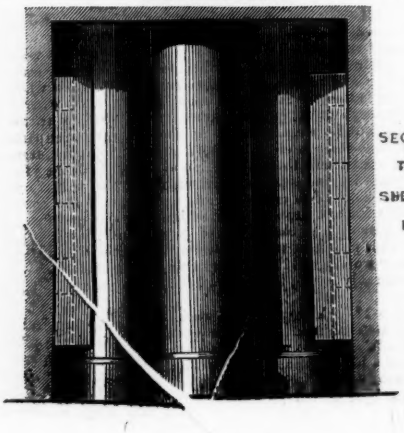
TRANSVERSE SECTION



LONCITUDINAL SECTION

SECTIONAL PLAN THRO' AA





SECTIONAL PLAN THRO' B.B. SHEWING RETORTS IN POSITION

temperature to be pretty equal over the entire oven. The number of retorts set in one arch is sometimes three, five, or even more; in Scotland, however, they rarely exceed five, and, unless in small works, never less than two large ones in each arch; the best being three, as with five in one arch the heat is never so good as with three. If only one furnace is employed, and if two furnaces are used, a better heat can be got by setting three retorts in separate arches (three in each arch), and one furnace to each set. You have thus the advantage of one more retort for the same fuel, and not much, if any, space lost, as a larger arch is required where five retorts are set in one arch. The other mode of setting two large retorts in one arch is, in my opinion, a great waste of space, for although there is a large yield of gas from the large retorts, it does not exceed that from three of a medium size, and more space is required; the space required for two large retorts being, from division wall to division wall, 8 feet 4 inches, and for three according to sketch 6 feet 4 inches, so that where a number of ovens are in use a considerable gain is effected by having three in one arch. In small works, where the increase in consumption is gradual, according to the season, a considerable saving is effected by having a single, double, and triple oven, so that the supply can be kept nearly equal to the consumpt.

In arranging the setting of retorts, there should be no more brickwork inside of the oven than is really necessary for the support of the retorts, as more is only so much obstruction, and more fuel is required to keep up the temperature. Dampers should be put into the flues in proper positions, so as to give an entire command of the draught; and these should be regulated according to circumstances, for should more air be admitted than is really necessary for the complete combustion of the fuel, it will lessen its heating power, and have a tendency to lower rather than increase the temperature, carrying off the caloric into the chimney. As it is necessary to allow sufficient time for the material brought into contact with to absorb the caloric, it therefore becomes imperative to keep the draught within proper limits, otherwise there is a decided waste of fuel. In some works the main flue is carried along under the bench, and some consider this a better plan than carrying it along the top of the bench, as it is thought there is still some advantage to be derived from the heated gas passing under. This advantage (if any) I am inclined to consider small; and the one passing over the top of the bench has the advantage of being easily opened and examined, by simply removing a cover, which can at once be replaced.

The workmanship and materials of the whole fabric must be of the best description, as if either are inferior great annoyance will result. Special attention should be directed to the composition of the clay from which the materials are made, such kinds as are free from oxide of iron, lime, &c., and contain a large amount of silica and alumina, being best adapted for withstanding heat without fusion. The fusibility of a substance does not, however, always depend on the elements composing it, but also on the manner in which they are arranged and combined together. It is very desirable to subject samples of all the materials used to a severe test before employing them to any great extent in works of this and similar kinds.

CORK GAS CONSUMERS COMPANY, LIMITED.

The Ordinary General Meeting of the Shareholders of this Company was held on Thursday, the 15th inst., at the Offices, South Mall, to receive the directors report, declare a dividend, and transact ordinary business—Mr. MAGUIRE, M.P., in the chair.

The SECRETARY (Mr. Lane) read the following report of the directors:—

Gentlemen,—You will perceive by the annexed accounts that the business of the company, for the year ending at Midsummer, has been in a satisfactory condition. There has been less increase than you may have been inclined to anticipate in the rental of the company, but the improved quality of the gas has of course operated to check the usual increase which takes place in the quantity consumed.

We have for the past year worked continually on the system patented by Messrs. Still and Lane—a system by which the coal tar produced on your works, the greater part of which is quite unsaleable here, has been employed to increase the illuminating power and the yield of gas, with results most profitable to the company. In consequence of the great reduction in the net cost of coals effected by this invention, we had hoped to be able to announce at the present meeting a reduction in the price of gas, but three causes have contributed to induce us to defer such an announcement for the present.

1. The additional municipal taxation to which we have become liable under the decision of the Recorder, from whose judgment there is no appeal. This at present amounts to £730, and varies in amount with the improvement and general purpose rate.

2. The great advance in the price of labour which has lately taken place in this city, and which began to operate but a very short time before the present accounts were closed, and which we estimate will increase your expenditure by £800 a year.

3. The nature of the contract with the corporation for supplying the public lamps by the average meter system—a mode which, although it may ultimately be as profitable to you as the former method, must in the commencement considerably diminish your income.

As these three causes will combine during the current year to diminish the profits of the company, we cannot, with a just regard for the interests of the proprietors, as yet recommend any reduction in the price of gas. We trust, however, at our next meeting to be able to make such an announcement.

It is only right to inform you that, up to the present time, Messrs. Still and Lane have received no remuneration whatever for the use of their patent, from which you have reaped such important advantages. They have left the question in the hands of the directors, and it is our intention to make you a proposal on the subject.

In our circular of the 26th of February we alluded to the loss of a cargo of coals in the steamship *Jacana*, but a question has arisen as to whether, under the circumstances, the owners of the vessel are not liable for the value of the cargo. The matter has been referred to arbitration, and, in the event of a decision against the company, the amount will be charged to the insurance account. In the meantime we have, as you will see by the accounts, put it to a suspense account.

We propose to declare a dividend of 4 per cent. for the first half year, which, with that already paid, will make up the usual dividend of the company. The dividend will amount to £4260, and the balance of £2700 we propose shall be added to the reserve-fund, which, with this addition, will not reach one-third of the amount to which it is limited by Parliament.

Two of your directors, Timothy Mahony, Esq., J.P., and James Murphy, Esq., D.L., retire by rotation, are eligible, and offer themselves for re-election.

The auditors, James Carnegie, Esq., and Denis M'Carthy Mahony, Esq., go out of office, and offer themselves for re-election.

The statement of accounts, which was taken as read, showed the following balance-sheet up to July 2, 1870:—

Dr.—To capital account paid on shares, including amount paid in advance of last call, £110,613 15s.; debentures, £18,100—£128,713 15s.; balance due to sundry persons, £1445 10s. 9d.; dividends unclaimed, £233 12s. 7d.; insurance-fund, £693 10s. 2d.; reserve for bad debts, £233 11s. 4d.; profit and loss, £6961 4s. 2d.; reserve-fund, £2088 7s. 9d.—£140,369 11s. 9d.

Cr.—By permanent investment to July 3, 1869, £110,507 2s. 4d.; extensions from above date to July 2, 1870—viz., works, £1540 8s. 3d.; mains, £660 1s. 11d.; services, £104 9s. 6d.; meters, £165 9s. 5d.; public lighting, £73 5s. 3d.; engineering, £50—£2593 14s. 4d.—£113,100 16s. 8d.; by bank, £4151 17s. 4d.; due by sundry persons, £1713 8s. 9d.; rental, £8027 11s. 9d.; public lamps, £2284 7s. 8d.; stock in trade, including mains, meters, coals, &c., £7686 0s. 1d.; Midland Great Western Railway Company for amount of reserve-fund invested in their debentures, £2000; Cork and Macroom Railway Company for do., £1150; insurance suspense account, £305 9s. 6d.—£140,369 11s. 9d.

The circular convening the meeting having been read,

The CHAIRMAN said: Gentlemen, I am placed in a somewhat embarrassing position, for I have to speak to you with respect to some points in the report, the words of which you have just heard from your secretary, Mr. Lane. However, it is necessary that I should refer to two or three matters of importance, and I shall do so as briefly as possible. First, as to the quality of the gas supplied by our company to the public. Its quality has been gradually improving, and of late has been remarkably high. In fact, since the 4th of June, it has averaged 16 sperm candles. I make this statement not on the authority of our officers, but on the statement of Mr. Ring, the officer of the corporation, who is very stringent in his tests, and who is supplied with the best and most perfect apparatus known to modern science. We are required by our Act to supply a standard of 14 candles to the consumer; but, according to an impartial official authority, we have been supplying it as high as 16 candles—two candles above the required average—which proves that the consumers of Cork need have no fear of a monopoly in the hands of their own fellow-citizens, all consumers themselves. As the report assures you, we were hoping to be able at this meeting to announce a reduction in the price to the consumer; but from the reasons stated we must defer the announcement to our next meeting. However, owing to the quality of the article we supply, we have given a practical reduction in the cost, and I may prove the assertion in this way—though we have several additional consumers the last half year, the consumption has not increased. The reason is that, as the light is better in quality, the public burn a lesser quantity. We have, then, given a practical reduction to the public, but we are most anxious to afford them a money reduction as soon as we can possibly do so. It is not necessary for me to dwell upon the three causes stated why this cannot be safely done at present—namely, the increased municipal taxation of £730, and the large increase of wages, as well as our public lamps contract with the corporation. Of the taxation I shall say nothing; and with respect to the increase of wages, I may simply state that it affects the company in every stage of its business. For instance, the increased cost of taking the coal from the ships to the works is equal to £200 a year, and this is but a single item of a large additional expenditure. I have something to say of the public lamps, and the plan now being carried out by the corporation; and in doing so, I premise that I speak without concert with my fellow-directors, who are not in any way responsible for my opinions. I speak partly as a citizen, anxious for the appearance of his city at night, and also as one much interested in the repute of this company. I have been in town some evenings of late, and the state of the lamps has excited my wonder, and indeed indignation; for, knowing the return made by Mr. Ring of the illuminating power, I could not reconcile it with the imperfect light I beheld. You can easily understand that my absence from Cork rendered me less acquainted than the other directors with the arrangements between the corporation and this company with respect to the public lighting; therefore I made inquiries as to the cause of this strange discrepancy between a high illuminating power and imperfect light in the lamps. The explanation was a very simple one—that the corporation were already supplying a considerably smaller quantity of gas per lamp than we were in the habit of supplying. The corporation estimate per lamp, for 4000 hours in the year, is a consumption of 12,000 cubic feet in the year, or 3 feet per hour. Now our supply was 5 feet per hour, as a rule; but it is well to mention that many lamps were known to consume 6 feet, and even 7 feet per hour. Our annual supply to each lamp was an average of 18,000 feet, but it rose frequently higher than that; but take it at 18,000. Well, the corporation, in the hope of effecting a saving of £1200 a year, which they intend to devote to the extension of lamps into other parts of the city, cut down the supply to 12,000 feet, or 3 feet per hour. In my judgment this is a most inadequate supply, and for this reason, not only that it is wholly insufficient, but that all our shops are closed at six o'clock, and in the long winter nights we must entirely depend upon the lamps for the illumination of our streets and highways. This is the public view I take of what I hold to be an unwise economy. Now the reason why I think this matter concerns the repute of the company is this, that the citizens of Cork may be holding us responsible for the inferiority of the public lights, and may say, "Oh, the lamps are in as bad a condition as they were in the worst days of the London monopoly." It is better, then, in my opinion, to anticipate the dissatisfaction which must result from this starving of the public lights, than to have to explain or account for it at a future time. Let it then be distinctly understood that the burners now in use in a great part of the city as being put by us for the corporation, under the direction of their engineer; that these burners will shortly be supplied to every part of the city; that they cannot consume more than 3 feet per hour; and that the difference between 3 feet and 5 feet per hour cannot be compensated for by increased illuminating power—that is, the maximum we give, namely 16 candles. It would take 23 or 25 candle gas to meet this extraordinary reduction. I therefore call attention to this very important matter in self-defence; and I ask the citizens of Cork, in case they are inclined to attribute the fault to this company, to turn from the public lamp to the shop or private house, and thus see if we are to blame for the state of the public lighting. At any rate, the remedy will be always at hand; for the corporation had only to abandon the 3 feet per hour burner, and replace it by one with a more liberal fluid. Now as to the dividend. We propose to make it the same as it has been from the beginning—8 per cent. on the year. This certainly is a good dividend; but, gentlemen, it would have been impossible for us to offer you that dividend, had it not been for one circumstance of great good fortune—the happy invention of our secretary and engineer, Mr. Lane and Mr. Still. The reason why we could not afford to pay this 8 per cent. was this—that the additional expenditure necessary to meet the requirement of our Act, and supply a minimum of 14-candle gas, was, roughly, about £3500 a year. The estimate of Mr. Anderson, our consulting engineer, placed it at a much higher figure. But owing to the adoption or use of the patent of Mr. Lane and Mr. Still, or of Mr. Still and Mr. Lane, we are enabled to meet this additional burden, and not diminish the dividend you have been in the habit of receiving. The nature of the invention consists in the thorough combination of small coal with the coal tar produced at your works—the greater part of which coal tar is unsaleable in this city, and had to be burned as fuel. All gas engineers have been aware of the great amount of illuminating power contained in the coal tar; but though they have tried various experiments, they have been unable to make use of it in consequence of the practical inconvenience arising from the stoppage of the pipes from deposits of tarry matter. What the gas engineers of the United Kingdom have been for many years trying in vain to accomplish, has been successfully achieved by the officers of this company, for the inconvenience I mention is entirely obviated by their discovery; and we can say, after a year and a half's trial of this invention, no such difficulty as the stoppage of pipes has arisen with us. As to the practical result of the use of the patent, I may refer you to the best proof of it—your large profit in the face of increased expenditure, and your balance at your bankers. But there is another test of its value—the process has been adopted by the Dublin Company, whose consumption is five times that of ours, and who are now erecting works on a large scale for the purpose of carrying it out. I understand that other companies are in negotiation for its use. Well, gentlemen, here is a valuable agent of securing your annual dividend—a practical means of diminishing the cost of production—a property due to the skill and perseverance of our officers; and we, as your representatives, were bound to consider not only the value of this invention, but the remuneration we should offer to those who placed it freely and unreservedly at our disposal. We could not rob them of the fruits of their long and patient labours—we could not deprive them of what is clearly their legal right. I can safely state that within my memory of meetings of our board, and that extends back to the formation of this company, I never knew any question considered with greater deliberation, or with more anxious care for your interests. We turned the matter in every point of view, especially as to the nature of the remuneration, or rather its mode and manner; for as to the necessity of remuneration there could be no question. We considered, for instance, whether it would be well to give a certain sum in hand, and a royalty on the profits for the 14 years

during which the patent would last; but we thought it more advisable on every account to give a certain sum, and be done with it. I may say it was unanimously resolved to offer those gentlemen a sum of £1000. or £500 each, in full acquittance of all demand, and that sum, moderate as it undoubtedly was, was freely accepted by Mr. Lane and Mr. Still, who, I must add, placed themselves unreservedly in our hands, expressing their willingness to consent to any arrangement we thought it right to make in their behalf. As to the moderateness of the amounts, two considerations guided our offer—the one, that they had the advantage of testing their experiment, and bringing it to maturity, in our works; the other, that its adoption and use by our company would be of much advantage to them in their dealing with other companies. I shall only add that, having given their utmost consideration to the question of remuneration, and decided according to what they deemed best for your interests, I may express the hope that you will endorse it with your unanimous approval, and thus express, as you have always done, your confidence in their zeal and judgment. Gentlemen, I shall not detain you longer, and now conclude by moving the adoption of the report.

Mr. ALCOCK said he had much pleasure in seconding the adoption of the report, so ably and so lucidly put by the chairman.

The report was unanimously adopted.

The CHAIRMAN said it was his duty to put the second resolution, which was that the directors were authorized to pay £1000 to Messrs. Still and Lane as remuneration for the use of their patent for the full term of its duration.

Mr. GREEN said he had much pleasure in seconding the proposition. When he came into the room he was quite prepared to hear a much larger amount moved for, and he thought the proposition exceedingly moderate. He considered that Messrs. Still and Lane, in consenting to accept it, showed their anxiety for the interest of the company was now as much as it was in the beginning.

The proposition was then put, and agreed to without a dissentient.

Mr. LANE said he had for himself and on the part of Mr. Still to thank, in the first place, the directors, and in the second place the shareholders, for the unanimity with which the last proposition had been agreed to. He was satisfied the directors would propose nothing to the shareholders unless they were conscientiously convinced it would be for the benefit of the company. And he would say, on the other hand, if there was anything in the proposition just passed calculated to diminish the dividend or to take a single farthing off the profits of the company, neither Mr. Still nor himself would have looked for a single penny. As regarded the application of the new process to the manufacture of gas, he held the full conviction, after a practical experience of more than a year and a half, that the problem had at length been solved which gas engineers had been trying in vain to solve during the past thirty years. They had found the practical inconvenience of the evils of the old system, they had striven, and he believed successfully, to obviate them, and he had every expectation, provided no accident happened, that the results of working by the new process for the current year would be better than last year. They were gradually improving in illuminating power, in which he did not think they had reached the limit they would yet attain. In Dublin, where experiments were being made on a large scale, the minimum achieved was already 16-candle gas—a point which must beyond question be exceeded. Under the operation of the new machinery, the largest of the kind ever applied, which the Dublin Company were about to erect, and of which the crushing machine alone would weigh 27 tons. He did not see why in the future manufacture of gas they should not be able to dispense with cannel altogether, and pay a maximum dividend.

Mr. J. M'MAHON then moved that a dividend at the rate of 8 per cent. per annum be declared for the half year on the paid-up capital of the company.

Mr. T. M'MAHON seconded the proposition, which passed.

Mr. DWYER then proposed that £350 be voted to the directors as remuneration for their services during the past year.

Mr. KELLER seconded the proposition.

The CHAIRMAN: I wonder that the two shareholders who made this proposition are not ashamed to suggest so modest an amount. I do not speak for myself, but if you knew the real value of your other directors, I am sure you would consider their services deserving of a much larger acknowledgment. I wonder the gentlemen did not blush when making the proposal. Do not ever do it again.

The proposition passed unanimously.

On the motion of Mr. GREEN, seconded by Mr. HALY, the outgoing directors, Messrs. T. Mahony and J. Murphy were re-elected; as also were the auditors, Messrs. Carnegie and M'C. Mahony.

On the motion of Mr. KELLER, seconded by Mr. DOWDEN,

Mr. T. MAHONY was then moved to the second chair.

Mr. M'OSTRICH proposed a vote of thanks to Mr. Maguire, and said that from the statement he had made that day it was evident their company was progressing. They were not only able to give their consumers good value, but they were able to continue their dividend. They were also able to remunerate two of their officers who had made a very great discovery. The directors had watched the process, but they did not think it necessary to bring the matter forward until they were thoroughly convinced that the invention would be productive of great good. He hoped Messrs. Still and Lane would go on prosperously with their invention, and that they would make money by it. It would not be of benefit merely to Cork, but would be of great value to every city where applied.

Mr. DANIEL REED seconded the vote of thanks, which passed amid acclamation.

Mr. MAGUIRE acknowledged the compliment, after which the proceedings terminated.

AN UNPROFITABLE GAS SPECULATION.—The Bottesford Gas Company has just issued its yearly balance-sheet (up to June 30), and we regret to observe that it is still an unremunerative property. The receipts amount to £119 12s. 6d. and the payments to £236 6s. 9d., the loss being £116 14s. 3d. There has been a new stack of retorts added, and the works extended to the amount of £66 6s. 7d. (which will not be required again for several years), and the interest on borrowed capital cost £62 19s. 7d. We are assured that the company is gradually extricating itself from the difficulties it has had to encounter by reason of the unmerited prejudice against it, and will, in a few years, become a profitable investment.—*Stamford Mercury.*

NICTHEROY (BRAZIL) GAS COMPANY, LIMITED.—By advices just received from Brazil it appears that the city of Nictheroy was lighted with gas on the day fixed by the authorities—viz., the 6th of August last; and that the Emperor visited the works on the 19th. Many applications, we are informed, for private lights have been made.

RUGBY GAS-WORKS.—The rapidly increasing demand for gas in this town has necessitated the erection of additional works, and the laying down of mains of larger diameter. The directors of the gas company were fortunate in obtaining a site for these new works upon land adjoining the railway stations, where they have been erected from designs prepared by Mr. P. Simpson, their manager, who has also had the superintendence of the building. The works, which were commenced in July, 1869, were formally opened on the 20th inst., when a dinner was given, at which the health of Mr. Simpson was proposed by the chairman, who spoke in very flattering terms of the talent and energy displayed by that gentleman.

REPORT ON GAS-BURNERS.

By Professor W. E. A. AIKIN.
Inspector of Illuminating Gas for the City of Baltimore.
[From the *American Chemist.*]

To the Honourable President and Members of the First Branch of the City Council.

Gentlemen,—Early in March the undersigned was requested by a resolution of your honourable body to furnish "all information in regard to the burners used for street-lamps and other purposes by the city authorities, and also his opinion as to the merits of the several burners used, and which is the most economical."

The reply to this inquiry I beg leave now to present, premising that its long delay has been unavoidable, as the time required for a careful comparison of the large number of sample burners presented could only be found during brief intervals of professional engagements. Understanding the inquiry as referring to the existing state of things, all my experiments have been conducted simply to determine what are the best burners to use with the gas of the Baltimore Gas Company, when burned under the average maximum pressure existing over a very large part of our city. With gas of uniform quality, the supply of air, the size and form of the orifice of the burner, and the velocity of the issuing jet, will all influence the light-giving power, and thus the same bulk of any gas may yield very different quantities of light, according to the burner used. The orifice may be too large or too small; the velocity of the stream, or, in other words, the pressure on the gas, may be too great or too little, and the combustion may be too rapid or too slow.

It is a mistaken idea to think to economize gas by using a burner with too small an orifice; with such we will always find a flame showing a large extent of non-luminous blue base. If, on the other hand, the orifice is too large, the escape of gas will be too abundant, the combustion will be imperfect, and the flame will be smoky.

The greatest obstacle in the economical consumption of gas is undoubtedly the great pressure in the street-mains. This pressure can be diminished in any building by partially closing the stop-cock behind the meter, between that and the main. But the objection made to this is that it has to be done every month where a wet meter is used, and is therefore troublesome. The same object can be accomplished in another manner—that is, we can retard the flow of the gas, and consequently diminish its velocity as it escapes from the burner by other means. All burners that profess to economize gas have some contrivance for this purpose. Sometimes a diaphragm of wire gauze and sometimes some fibrous material, as wool or cotton, is placed in the body of the burner; but in time these are liable to become obstructed, and so impervious as to require to be removed and renewed.

Of the various methods employed for checking the flow of gas from the burner which have come under my notice, the plan adopted in the double burner arrangement appears to be the most effectual and the most economical. The Cylinder burner, the American patent, the Young America, and the Imperial gas economizers, are constructed on this principle. In other forms of burners examined there are elaborate and ingenious devices intended to accomplish the same thing—to control the flow of the gas. Among these I may name the "Index burner," a double burner with an index regulator inside; the "Mill burner," with a screw regulator on the outside; and the "Avery burner," which claims to have a self-acting valve, all apparently not so well fitted for general and common use. The same may be said of some special contrivances for increasing the light of a given flame, such as "Scholl's platina perfecter," adapted to the Union jet, and the cap of the "More Light burner" used on a bat's-wing. The last, by interfering with the direct contact between the air and the base of the flame on one side, appears to increase the light by restricting the extent of this non-luminous blue base. The action of these will be found noted in the table of results appended. So far as any conclusions can be drawn from my experiments, a brief glance at the table will show that the burners that interpose a check to the flow of gas when used under high pressure are much better than those that have no such check. Those known as the American patent, the Cylinder burner, and the Imperial gas economizers, have given the most satisfactory record. By substituting one or other of these for the old-fashioned open iron or brass single burners, which offer no obstacle to the flow of gas, a much less quantity can be made to yield the same amount of light. And in that proportion the burners recommended will prove most economical. "Tufts' street burner," said to be in use on the street-lamps in Boston, has connected with it a regulator intended to equalize the flow of gas under varying pressure. Whether better than those named above could not be determined from my limited examination. It is stated that the double or cylinder burners are largely used in New York city on the public lamps, and the Young America burners in Cincinnati and in Buffalo. In my trials the "American patent" has done better than either of the others. It is hardly necessary to add that all the burners, in a gross of any kind, are not likely to be equally perfect. The best form of burner being ascertained, the material of which it is made is an important consideration. Of two equally good in all other respects, that one will be the best which will last longest unchanged. A metal-tipped burner will corrode and become unfit for use by the action of heat much sooner than a lava or porcelain tip, and therefore the latter are to be preferred. Where a very bright light is required, the Argand burner, as a general rule, is the best. But their greater cost and greater trouble in using, with the breakage of chimneys, interpose to prevent their common use. They are not the most economical where a larger amount of light will suffice; in such case, the bat's-wing, or Union jet, is better fitted. Among the Arganda tried, "Sugg's New London Standard," with a 6-inch chimney, is the most remarkable, supplying the light of 18 candles by the consumption of 4 cubic feet of gas per hour. Having but a single sample of the kind, I cannot say whether this fairly represents the average power.

The first column of figures in the table gives the pressure on the street-main, represented by the height of a column of water in inches and tenths. The second column gives the pressure at the burner; the third gives the estimated consuming power of the burner in cubic feet per hour; the fourth gives the actual consumption in cubic feet per hour, and the fifth column gives the illuminating power of the burner used. The temperature of the photometer-room ranged from 60° to 65° Fahr. The candle power of the gas by the standard Argand was 18 candles. No attempt was made to determine which burner would give the most light under the most favourable conditions. The only inquiry was which burner would give the most light under existing conditions. The governor was therefore thrown aside, and a connexion was made with the street-main, and the gas was burned as when in ordinary use by the public.

ARGAND BURNERS.	Pressure in Street-Mains.	Diameter of Ring.	No. of Holes.	Height of Chimney in Inches.	Pressure at Burner.	Consumption P. Hour p. Cub. Foot.	Illum. Power in Candles.
Noiseless Argand . . .	3·5	1	40	7	·6	6·	19
Ditto.	3·5	1	40	7	·6	5·5	18
Ditto.	3·5	¾	36	7	·6	4·5	15
Rhode Island Argand. .	3·5	1	40	7	1·1	4·5	14
Ditto.	3·5	1	40	7	·6	6·	18
Ditto.	3·5	1	40	7	·5	5·	16
Sugg's, Letheby's stand.	3·5	¾	15	7	·3	4·5	16
Sugg's New London . .	3·5	¾	24	6	·3	4·	18
Standard Argand . . .	3·5	1	15	7	·4	5·	18

Table of Light-giving Power of Different Burners.

Union Jet Burners.	Pressure in Street-Mains.	Pressure at Burner.	Burner rated at Cub. Ft. per Hour.	Gas consumed, Cub. Ft. per Hour.	Illum. Power in Candles.
American patent	3·5	2·1	3·	4·75	18
Young America	3·5	2·7	3·	3·	11
Mill burner, maximum	3·3	1·6	4·	6·	18
Ditto, minimum	3·3	2·1	4·	5·	15
American patent	3·3	2·1	4·	5·	17
Iron double burner	3·3	2·3	4·	4·	9
Cylinder ditto	3·3	1·4	4·	4·5	16
Ditto	3·3	1·2	4·	4·	16
Ditto	3·3	1·9	4·	5·5	18
Young America	3·3	2·3	4·	4·5	18
Imperial burner	3·3	1·6	4·	6·	17
Ditto	3·3	1·1	4·	4·	14
Iron single burner, no check	3·3	1·8	4·	5·5	15
Mill burner	3·5	1·9	5·	5·5	11
Cylinder ditto	3·5	1·4	5·	4·	17
American patent	3·5	2·2	5·	5·5	14
Avery valve burner	3·5	1·6	5·	5·	16
American patent	3·5	1·8	5·	4·75	18
Young America	3·5	2·	5·	5·5	20
Imperial burner	3·5	0·9	5·	4·	11
Ditto single burner, no check	3·5	1·3	5·	6·	16
Mill burner	3·5	1·5	6·	5·5	17
Cylinder ditto	3·5	1·9	6·	5·	18
Young America	3·5	1·8	6·	5·	17
Imperial burner	3·5	1·5	6·	5·5	14
Ditto gas economizers	3·5	2·7	3·	3·	8
Ditto ditto	3·5	2·2	4·	4·5	14
Ditto ditto	3·5	1·8	5·	5·5	17
Ditto ditto	3·5	1·6	6·	6·	19
Glass burner, Myers' patent	3·5	2·1	..	4·5	14
Burner, Scholl's platina perfecter	3·5	1·8	5·	5·5	17
Ditto, without ditto	3·5	1·7	5·	5·5	10
Index burner	3·5	2·8	1·	2·5	7
Ditto	3·5	2·3	2·	4·	13
Ditto	3·5	2·1	3·	4·5	15
Ditto	3·5	1·1	6·	6·5	19

Bat's-Wing Burners.	Pressure in Street-Mains.	Pressure at Burner.	Burner rated at Cub. Ft. per Hour.	Gas consumed, Cub. Ft. per Hour.	Illum. Power in Candles.
Cylinder burner	3·8	2·6	3	3·75	14
Young America	3·5	2·6	3	3·5	13
American patent	3·5	2·2	3	4·5	19
Ditto	3·5	2·1	4	4·75	19
Cylinder burner	3·5	1·7	4	5·5	20
Young America	3·5	2·2	4	3·5	15
Iron double burner	3·5	2·4	4	4·	14
Imperial ditto	3·5	1·7	4	6·	20
Cylinder ditto	3·5	2·	4	5·	18
Mill ditto, maximum	3·3	1·8	5	6·	18
Ditto ditto, minimum	3·3	2·1	5	5·	16
Cylinder ditto	3·3	1·3	5	5·	18
Iron double ditto	3·3	1·8	5	4·25	16
Cylinder ditto	3·3	2·1	5	4·25	16
American patent	3·3	1·7	5	5·25	18
Young America	3·3	1·7	5	5·25	18
Imperial burner	3·5	1·4	5	6·	16
Mill ditto	3·5	1·5	6	5·5	17
Cylinder ditto	3·5	1·2	6	6·	20
Iron double ditto	3·5	1·6	6	5·	18
American patent	3·5	1·9	6	5·	17
Young America	3·5	1·8	6	4·5	17
Imperial burner	3·5	1·	6	6·	20
Glass ditto, Myers' patent	3·5	1·5	..	6·	19
Tufts' patent street burner	3·5	2·2	..	4·	14
"More Light" patent, with cap	3·5	1·9	5	5·5	19
Ditto, without cap	3·5	1·9	5	5·5	14
Ditto, with cap fixed	3·5	1·9	5	5·	16
Iron double burner, for street-lamp	3·5	1·8	5	5·	13
Ditto, ditto	3·5	2·2	5	4·5	11
Ditto, ditto	3·5	1·5	5	5·5	14
Ditto, ditto	3·5	2·	5	4·5	12
Ditto, ditto	3·5	1·8	5	..	12
Ditto, ditto	3·5	2·2	5	4·25	12
Ditto, ditto	3·5	2·4	5	5·55	13
Ditto, ditto	3·5	2·3	5	5·5	14
Ditto, ditto	3·5	2·1	5	6·25	16

In conclusion, it only remains to return my thanks to those who have kindly supplied burners for examination. To Messrs. Rodgers and Son I am indebted for the loan of a very large assortment, including some forty different kinds; to Messrs. Ault and M'Evoy for samples of Scholl's, Sugg's, and Letheby's English and an assortment of American burners; to Messrs. Davidson and Co., for the "More Light," the Avery, and various others; and to Messrs. Brooke, Grimes, Pope and Cole, Saunders (of the gas company's office), and M'Laughlin, of our own city; and to Messrs. Tufts, of Boston, E. P. Gleason, Archer, and Pancoast, of New York, and C. Gefroser, of Philadelphia, for numerous samples of the most reliable burners in use.

Register of New Patents.

2327.—John Thomas Way, of 9, Russell Road, Kensington, in the co. of Middlesex, for "*Improvements in the manufacture of manures and in the purification of gas.*" Patent dated Aug. 3, 1869.

This invention has for its object improvements in the manufacture of manures and in the purification of gas, and the first part consists in the production of manures containing phosphates of ammonia by means of diphosphate of lime, a substance described in a previous patent, No. 2344, bearing date the 14th of August, 1867.

The solutions containing ammonia or carbonate of ammonia are brought in contact with the diphosphate of lime, by which the ammonia is converted into phosphate of ammonia. The solution is evaporated with or without previous filtration and separation of the phosphate of lime, and the product is employed as manure. This process is applicable to the treatment of ammoniacal liquors, such as the ammoniacal liquor of gas-works. To such liquors is added from 15 to 20 lbs. of dry diphosphate of lime (or a quantity of wet diphosphate, containing 15 or 20 lbs.) for each pound of ammonia contained in the liquor. For instance, to 1000 gallons of gas liquor, containing 2 per cent. of ammonia or 200 lbs., from 3000 lbs. to 4000 lbs. of diphosphate of lime are added. The diphosphate is mixed with a quantity of liquor sufficient to make it into a thin paste, and the mixture is heated by steam or otherwise to a temperature of 150° to 200° Fahr. The remainder of the liquor is then added by degrees, continuing the heat until the smell of ammonia disappears or is greatly reduced, and the mixture is evaporated to dryness at a temperature not exceeding 212° Fahr. The product contains phosphate of ammonia and triphosphate of lime, the latter in a highly divided state. It is very suitable for manure, especially on light soils. Or to solutions containing ammonia or carbonate of ammonia is added caustic lime, and it is distilled over by heat or by a current of heated air, the ammoniacal vapour being condensed in diphosphate of lime, by which means phosphate of ammonia is formed as in the first instance. This process is applicable especially when the ammoniacal liquor contains a large proportion of tarry matters. Lime is added to it, and the ammonia is distilled by employing a current of air blown or pumped through the ammoniacal liquor to which lime has been added. The liquor is warmed to facilitate the escape of the ammonia, or the air is heated before passing it into the liquor. The air so charged with ammonia is then passed through a chamber or chambers containing diphosphate of lime distributed on perforated shelves. These chambers are heated by steam-pipes, or other suitable means, so that the watery vapour accompanying the ammoniacal vapour is unable to condense, and is allowed to escape whilst the ammonia is arrested by the diphosphate of lime. It is preferred to employ several such chambers arranged in series, so that the vapour leaving the first passes into a second, and so on, by which means the last portions of ammonia are secured. When the diphosphate of lime in the chamber which first receives the vapour is saturated with ammonia, the chamber is shut off from the series to be emptied, and refilled with fresh diphosphate, and the vapour is diverted into the second chamber, which then becomes the first in the series, the newly filled chamber being now the last. In this way a dry or comparatively dry product is obtained without a second evaporation. The use of air to carry over the ammonia may be omitted, or the process may be varied by condensing the ammonia in water or acid in the usual way, and adding the diphosphate of lime to the solution. If it is desired to have the phosphate of ammonia produced by any of the foregoing methods separate from the phosphate of lime, the insoluble portion is removed by subsidence or filtration, and the liquid is evaporated to dryness at a gentle temperature; or when the product is dry it is digested in water in order to separate the soluble and insoluble portions. The insoluble portion, which is principally triphosphate of lime with some phosphate of ammonia, is valuable as manure, or may be reconverted into diphosphate of lime by one or other of the processes described in the before-mentioned patent for the manufacture of that substance.

The second part of the invention consists in the use of diphosphate of lime to separate ammonia from coal or other illuminating gas. The gas is caused to pass through a chamber containing diphosphate of lime distributed on perforated shelves, or other suitable arrangement, by which means any ammonia contained in the gas is arrested as phosphate of ammonia. When the diphosphate has become sufficiently saturated, it is removed for use as manure, or the phosphate of ammonia is separated by treatment with water, as before described. When using diphosphate of lime in the purification of gas, the gas is caused, after passing through the ordinary lime purifier, to pass through a vessel containing diphosphate of lime distributed on perforated plates. The apparatus now in use for purifying gas by dry lime is very suitable for this purpose, diphosphate of lime being substituted for hydrate of lime. When the gas is first passed through a dry lime purifier, it is found desirable that, before coming in contact with the diphosphate of lime, it should be made to pass through a vessel of water, in order that it may take up sufficient moisture to enable the diphosphate more readily to absorb the ammonia. The diphosphate of lime may be advantageously employed on the small scale to arrest from gas before it is burnt any portion of ammonia which has escaped the ordinary purifying processes. A few pounds of the diphosphate distributed on shelves in a small vessel through which the gas is caused to pass will be sufficient to purify from ammonia all the gas required for the supply of an ordinary dwelling-house for many months. The gas may conveniently be passed through the purifying vessel in its passage from the meter to the burners. When the diphosphate of lime is saturated with ammonia, it is used as manure, or the soluble portion is dissolved out, as previously described.

2330.—Isaiah Davies, of Harborne, in the co. of Stafford, mechanical engineer, for "*Improvements in rotary gas-exhausters.*" Patent dated Aug. 3, 1869.

This invention was fully described in the Journal of Aug. 2, page 587.

2346.—Benjamin Joseph Barnard Mills, of 35, Southampton Buildings, in the co. of Middlesex, patent agent, for "*Improvements in meters for measuring liquids and gases.*" A communication. Patent dated Aug. 5, 1869.

This meter is constructed with a piston and valve mechanism, which moves without appreciable friction or consumption of power. The throw of the valves is instantaneous when the stroke is to be changed, and the apparatus is adapted to operate with uniform accuracy under variations in the pressure and volume of the fluid to be measured.

2354.—William Robert Lake, of 8, Southampton Buildings, London, consulting engineer, for "*Improvements in devices for holding the chimneys of gas-burners and other lighting apparatus.*" A communication. Patent dated Aug. 6, 1869.

According to this invention the chimney-holder consists of a ring fitting the body of a gas-burner, with a number of radial arms for supporting the weight of the chimney. At the end of each arm is riveted a spring, which bears against the chimney, to hold it securely in its place over the gas-burner. This spring is formed of a strip or plate of metal riveted to the arm, so as to bring the flat portion of the strip or plate of metal forming it directly against the chimney, while the arm is riveted to the ring, so as to present its narrow end as the point to which the spring is riveted. The strip or plate of sheet metal, before being riveted to the arm, is bent forward sufficiently to cause it, when riveted to the arm, to form a spring, against which the sides of the chimney, when inserted, shall bear. A second spring or spring tongue is formed from the plate or strip of sheet metal constituting the spring, by punching it from the body of the strip or plate of metal, in which case the stiffness of the spring is reduced, and the pressure of the two springs upon the chimney is in a measure equalized; or the spring may be formed of a separate piece of metal, and riveted to the spring, in which case the spring is made semi-elliptic in form, with its ends curved, and is so riveted to the spring that the upper curved portion shall extend above the point of riveting, and the lower curved portion shall extend below the curved point of riveting.

2395.—Samuel Joseph Woodhouse, of Holbeck, Leeds, in the co. of York, gas inspector, for "*Improved apparatus for purifying and regulating the supply of gas to burners, and also for an improved standard tap.*" Patent dated Aug. 10, 1869.

This apparatus consists of a case made of brass or other suitable material attached to the meter by means of a pipe and a union joint. In the inside of this outer case is a moveable cylinder enclosed at the top, the circumference of which is perforated with longitudinal apertures wider in the middle and diminishing to the two points. The size of such apertures is caused to be pierced for any given number of lights at the rate of a thirty-second part of a square inch per light, which is found sufficient after allowing a third more of that quantity for friction, varying according to the different elevation where the gas is consumed, and so in proportion for any number of lights. As the gas from the meter first enters the apparatus, it is received into a cylinder open at the top, filled with carbon consisting of 3 parts of charcoal and 1 of copperas, enclosed in a covering of wire gauze or other suitable material. The perforated moveable cylinder is placed over

the carbon case; over the two last-named cylinders is placed the outer case before referred to, the upper part of which has an inner shell, there being a space between it and the outer case. Two packing-rings of leather, oiled silk, or other suitable substance, are placed at the bottom portion of this inner shell, and between these rings apertures are made of convenient size and distances from each other. As the gas is forced by pressure through the carbon case, it raises the perforated moveable cylinder till the top portion of the longitudinal perforations reach the level of the perforations in the space between the packing-rings, and as the taps to the burners are turned on, the gas passes into the chamber between the outer case and the inner shell through an outlet at the top of the apparatus, and thence to the burner. As the quantity of gas required is more or less, so the moveable cylinder is raised or lowered, so that as it rises the widest parts of the longitudinal perforations being brought gradually opposite to the perforations between the rings, more gas is allowed to pass through, and as a less quantity is required, the moveable cylinder gradually rises and the size of the perforations diminishes. This portion of the improvements is peculiarly applicable for mills and large buildings, or where a large supply is required.

Another portion of the improvements consists in a standard tap, which is as follows:—The stopper is made hollow, one-half the circumference of which is drilled or pierced with holes of different sizes, but made on the same scale as the perforations in the moveable cylinder before mentioned, the other half of the circumference opposite to the perforations being a longitudinal outlet. The gas passes into the tap through the perforation in size according to the amount of gas required sufficient to supply the number of lights requisite, and to regulate which on the flange of the thumb-piece of the tap is an index denoting by figures different numbers of lights. As the tap is turned to any of these figures, a corresponding perforation sufficient to allow gas to supply that number of lights is brought opposite to the outlet to the burner.

As it is essential that the perforations in the tap and in the perforated cylinder before mentioned should retain the dimensions intended, and as the action of the gas is likely to corrode or choke up those perforations to some extent, if made of such materials at present used for such purposes, to obviate this they are cast or made of a material composed of block tin and copper, mixed in such proportions as will check such corrosion or choking up of the perforations. The union joint which connects the purifying apparatus to the meter is made of the same material also.

2414.—William Edward Newton, of 66, Chancery Lane, in the co. of Middlesex, civil engineer, for "*Improvements in centrifugal pumps.*" A communication. Patent dated Aug. 12, 1869.

These improvements consist in such a construction of the working parts of the pump as that, while the vanes are restricted to the suction side or face of their revolving disc or carrier, the step bearing on such side or face may be dispensed with. The vanes are arranged to meet in the centre of the carrier, and the latter is balanced or supported by reason of a vacuum established on the back of such carrier by or through the action of the vanes, as arranged on the front of it.

2416.—William Robert Lake, of 8, Southampton Buildings, London, consulting engineer, for "*Improvements in machinery for charging gas-retorts.*" A communication. Patent dated Aug. 12, 1869.

The said invention relates to a mechanical organism, through the agency of which gas-retorts can be more expeditiously and properly charged with coal, and with less labour and cost than by any method hitherto known or practised. This organism consists of an elongated shallow open box, in which is adjusted a moveable and reversible web, or link bottom or apron, and proper means for operating the same sustained in a guide-way or sheath in such manner as to have a reciprocating endwise motion corresponding in its extent with the length of the retort, the said guide-way being supported on a proper frame or carriage on wheels, resting on a railway, so as to be moveable, and, therefore, readily susceptible of being taken from one bench of retorts to another, and into the coal-store. In other words, the said invention relates to a machine which charges gas-retorts without further hand labour than is requisite to place the coal in it, and then to cause the same to be discharged into the retort, the operation being effected with great economy of time and labour, as compared with any other mode that has hitherto been practised.

2445.—Henri Adrien Bonneville, of 10, Sackville Street, Piccadilly, in the co. of Middlesex, patent agent, for "*Improvements in the process of charging and discharging fuel in gas-retorts or other gas-distilling apparatus.*" A communication. Provisional protection only obtained. Dated Aug. 16, 1869.

The first part of this invention consists of a charging apparatus set on a rotary carriage, and intended to charge speedily and mechanically a retort or other receiver with coal, peat, or other fuel to be distilled for manufacturing gas and coke.

The second part of the invention refers to a discharging apparatus to turn out the fuel contained in the retort when transformed into coke by distillation. These operations have been effected heretofore by manual labour, and by means of a shovel, and it is to save the operators this excessive exertion that the following mechanical device has been contrived.

The charging apparatus is set upon a carriage running on rails, and is composed of a semi-cylinder of sheet iron or other metal, one end of which is provided with a weight so as to balance the charge which is in the cylinder. The apparatus thus contrived, borne upon its carriage, is made to sink into the bottom of the retort the sheet-iron cylinder with its charge; when introduced, the semi-cylinder gets half expanded or separated lengthwise in two partsy b means of levers, so as to spread the fuel in the retort or oven in regular layers. This operation requires but a few seconds, and is a very advantageous substitute for the charging oy shovel, as done in works at present. This latter process takes about three minutes, during which time the purest and richest caloric and gas evolve to a great extent, and thus constitutes a great waste.

The distinctive principle of the apparatus is the opening and separating into two parts the cylinder, each part describing a course similar to the configuration of the retort employed. This apparatus is intended to serve successively and speedily for all the retorts in use.

Secondly, the discharging apparatus consists of a carriage set upon wheels and running on rails, which may be made to move vertically, or to rise by means of screws or otherwise, so as to stand opposite to each retort it is to discharge. On this carriage are arranged five rods maintained in position by iron braces, the rods being of a curved shape, so as to fit on the retorts and facilitate their introduction into the space existing between the upper part of the retort and the charge contained therein. Two of these rods are secured to the carriage, and their ends are jointed by means of hinges to a similarly curved plate, which is moveable, and made to rock by the action of a third rod moving to and fro by means of a lever. The two other rods bear iron bars, and have two distinct motions, one rotary, imparted by hand levers to turn about the pokers and make them break the fuel, and the other a longitudinal to-and-fro motion imparted to them by little levers, whereby they are made to withdraw the pokers after the breaking operation, so as to leave a free space to lodge the bottom plate in. The apparatus having thus penetrated into the retort, the workmen seize upon the levers, and force them down so as to cause the rotation of the rods, and break or cut the fuel by means of the pokers. This first operation over, they raise up the lever, which at the same time causes the moveable plate to oscillate, and draws out the pokers and the fuel, leaving between the two last pokers an empty space wherein the moveable plate is to be lodged. In this position the apparatus is drawn by means of a handle, and the crucible is discharged.

2478.—Archibald Gilchrist, of Glasgow, in the co. of Lanark, N.B., engineer and shipbuilder, for "*Improvements in slide-valves.*" Patent dated Aug. 19, 1869.

This invention consists in adapting to what are known as double-ported passages a valve which works between the ordinary port-face and a black plate fixed in the valve-casing so as to prevent the pressure of the steam or other fluid from acting on the back of the valve.

2482.—Frederick Braby, of Fitzroy Works, Euston Road, in the co. of Middlesex, for "*Improvements in the means and apparatus for the manufacture of caustic ammonia and ammoniacal salts.*" Patent dated Aug. 19, 1869.

This invention has chiefly reference to a process for the extrication and condensation of ammonia described in certain letters patent granted to I. Baggs and F. Braby, bearing date June 27, 1868 (No. 2067), and consists in certain improved means and apparatus for practically carrying out such process.

For this purpose in one arrangement of apparatus the gas or other liquor from which the ammonia is to be extracted is introduced together with lime into a boiler, still, or generator of wrought iron, or other suitable metal, set in brickwork, and heated either by means of a fire underneath, the flames from which are made to pass over a great portion of its external surface, or by means of hot air or steam-pipes situated inside the still, or by steam or hot air blown directly into the still. In this latter method of heating the generator may be of wood, or of wood lined with metal, or even of cement and brickwork, or asphalte, or other material. A spindle passes through the generator, armed with a number of beaters or fans constantly kept revolving in the liquor. Air is forced by means of a force-pump, fan, bellows, or other blowing apparatus into perforated pipes, situated inside the still, the perforations of which increase in number and size as they are further from the inlet of air. Through these perforations the air passes in bubbles among the gas liquor, is caught up by the fans, and in thus, together with the lime, being brought into intimate contact with the various constituents of the gas liquor—viz., water, ammonia, carbonic dioxide, sulphuretted hydrogen, sulphocyanides, &c. takes up the ammonia, and passes together with the same into the steam or air chest of the boiler, whence it is conducted through a pipe into a purifier or washer. This consists of a wooden or iron vessel of comparatively small capacity containing lime, and being about one-third full of water. It is closed at the top, and is provided with a perforated false bottom or diaphragm, the perforations of which increase in size and number as they radiate from the point at which the air, charged with ammonia, is introduced beneath the diaphragm. This purifier is furthermore provided with a revolving stirrer or agitator having revolving blades above and below the perforated diaphragm, so as to bring the alkaline vapour carried by the air into intimate contact with the solution of lime, and two trial taps fixed at proper heights serve to test for gas and water. There is also a pipe, sealed at one end, extending about halfway from the bottom, for conducting away any excess of liquid that may accumulate by condensation of aqueous vapour coming over from the still with the alkaline air. Lastly, a safety-pipe is provided for relieving the washer of any excess of pressure. Safety and vacuum valves are also provided to the generator or still. In the washer the ammonia is deprived of any remaining hydrosulphuric acid or other impurity that may have escaped the action of the lime in the still or generator. When the lime in the washer has taken up so much of such impurities as to lose its efficacy, it is caused to pass from the washer into the generator through a pipe at the bottom provided with a tap, and a fresh charge is introduced into the washer. The air and ammoniacal gas pass from the washer through a pipe at the top thereof into a coil or worm contained in a cold-water cistern, which coil opens into the bottom of a deep close vessel, about one-third full of pure cold water or ice, which vessel is provided with one or more perforated diaphragms upon which are placed, if necessary, shallow layers of pebbles. The air charged with ammonia in bubbling up through the water, with which it is brought into intimate contact by passing through the perforations of the diaphragms and through the layers of pebbles, parts with a certain quantity of the ammonia to the water, and on issuing into the space above the same it is conducted through bent pipes in succession through one, two, or more similar vessels, the water in which gradually absorbs nearly the whole of the ammonia, so that from the last of them the air is allowed to escape into the atmosphere. The water in the receivers is to be kept very cold by any convenient means, and the blowing of air through the perforated pipes may be intermittent or discontinued during a portion of the process. The last vessel or receiver may contain instead of water a strong solution of chloride of iron or sulphate of iron, which, being denser, and possessing a higher specific gravity than water, offers a greater pressure and resistance to the passage of the gas. The iron salt thus produced is decomposed with formation of muriate of ammonia, or sulphate of ammonia in solution, and the deposition of a sesquioxide of iron, which, when calcined and prepared, affords a good pigment. When, instead of caustic ammonia, it is desired to manufacture ammoniacal salts, the receivers are charged with sulphuric or muriatic acid, or a metallic or saline solution capable of arresting the ammonia. The saturated liquid salt is run from the receivers into shallow pans, and is evaporated to the crystallizing point by means of heat, and by means of air blown into the liquid from perforated pipes or from below a perforated false bottom.

In another arrangement of apparatus the ammoniacal gas liquor, having been first purified by means of lime and by agitation, is allowed to fall through a vertical shaft or oblong chamber, provided with a series of trays or shelves, arranged to project alternately from opposite sides of the shaft, so that the gas liquor in falling has to pass from one tray to the next below, thus constantly presenting in its downward course a great and continually changing surface, so that the atmospheric air which is forced in from near the bottom of the shaft in its upward course, passes through and in intimate contact with the falling liquor, thereby taking up from such liquor the ammonia held in solution thereby. The beforementioned shelves may be partially perforated so as to allow both the air to bubble up through the perforations, and the liquor to drop partially down through the same, thus still further increasing the contact between the air and liquor. Or in place of such shelves, complete perforated diaphrams may be employed with or without overflow-pipes leading from above one diaphragm to the next below, so that the whole of the air, in forcing its way upwards, has to bubble up consecutively through the layers of liquor contained on each of the diaphragms, and at the same time comes in contact with the liquor falling down from one diaphragm to another. The ammoniacal liquor may also be passed through the above-described apparatus without previous purification; in such case the sulphuretted hydrogen and other impurities are disposed of in any other well-known manner. The liquor may be passed through the apparatus either in a heated or in a cool state. The air loaded with the volatile alkali and some aqueous vapour is conducted through a pipe from the closed top of the apparatus, first into a washer with lime water, and then into receivers of ice water, acid, or metallic, or saline solutions, according to the produce desired to be obtained, as before described in connexion with the arrangement os apparatus.

In a third arrangement of apparatus the gas liquor is introduced with or without the addition of lime into a large long closed vessel, one part of which is deeper than the other, and contains a revolving bucket-wheel, by means of which the gas liquor is raised from the bottom of the vessel and is deposited in a trough, along which it flows to the other part of the vessel, where it is caused to fall on to the uppermost of two or more perforated shelves projecting alternately from opposite sides of the vessel, so that the liquor passes down from the one to the other of these shelves both by flowing over the edges of the shelves, and by dropping through the perforations. Or perforated diaphragms may be employed, through the perforations of which the whole of the liquor has to pass.

At the bottom of the shallower part of the vessel is introduced air under pressure, which in rising up is brought into intimate contact with the falling liquor, and takes up the ammonia therefrom, after which it is conducted away to be purified, and then deprived of its ammonia, as in the previous cases. The gas liquor after falling down through the shelves or diaphragms passes again into the deeper part of the vessel, where it is again raised by the bucket-wheel, and so on repeatedly until the charge of liquor has been deprived of all its ammonia. The vessel or generator may, if requisite, be heated by means of a fire or by hot air or steam pipes. In this arrangement of apparatus steam may be introduced in place of air as the medium for taking up the ammonia from the gas liquor.

APPLICATIONS FOR LETTERS PATENT.

2437.—GEORGE HENRY ELLIS, of 20, High Holborn, in the co. of Middlesex, engineer, for "*Improvements in steam, gas, and air engines.*" Sept. 9, 1870.

2451.—ARCADI STOLIPINE, of St. Petersburgh, in the empire of Russia, manufacturer, for "*An apparatus for lighting with legroine gas (petroleum spirits).*" Sept. 10, 1870.

2460.—ALFRED TYLOR, of 2, Newgate Street, in the City of London, brass-founder, for "*Improvements in wet and dry closets, and in apparatus connected therewith.*" Sept. 12, 1870.

2472.—THOMAS ONION, of 12, Leicester Road, Loughborough, in the co. of Leicester, for "*Improvements in apparatus for measuring the flow of water or other liquids.*" Sept. 14, 1870.

2497.—ISAAC HAIGH, JOHN HAIGH, and ISAAC HAIGH, jun., of West Bromwich, in the co. of Stafford, plumbers, for "*Certain improvements in apparatus in connexion with water-closets.*" Sept. 16, 1870.

2505.—THOMAS WALTON, of the firm of Walton and Brear, of Bradford, in the co. of York, plumbers, glaziers, gas and steam fitters, for "*An improved means or apparatus for ventilating rooms or buildings.*" Sept. 17, 1870.

2506.—EDWARD KIDD, of Birmingham, in the co. of Warwick, manufacturer, and GEORGE BOURNE, of the same place, engineer, for "*An improved water-gauge.*" Sept. 17, 1870.

2516.—GUSTAV BISCHOF, jun., of Bonn, in the kingdom of Prussia, but at present residing at the Craven Hotel, Craven Street, Strand, in the co. of Middlesex, for "*Improvements in the means employed for the purification of water.*" Sept. 19, 1870.

2517.—HENRY HARRIS, of Southampton, in the co. of Hants, picture restorer, for "*Improvements in filtering and in apparatus for the purpose.*" Sept. 19, 1870.

2521.—ALEXANDER HORACE BRANDON, of 13, Rue Gaillon, Paris, in the empire of France, engineer, for "*Improvements in vapour or gas burners.*" A communication. Sept. 19, 1870.

2534.—FERRAR FENTON, of Dewsbury, in the co. of York, and SAMUEL HOLLINS, of Bolton, in the co. of Lancaster, for "*Improvements in the deodorization andutilization of sewage or other feculent or putrescent matter, whether in a solid, fluid, or semi-fluid state.*" Sept. 21, 1870.

GRANTS OF PROVISIONAL PROTECTION.

2229.—THOMAS PENN, of 40, Westbury Street, Wandsworth Road, Clapham, in the co. of Surrey, for "*An improved method of regulating the opening and closing of water-closet and other cocks by hydraulic pressure.*" Aug. 11, 1870.

2275.—ALFRED WILLMER POCOCK, of Pimlico, in the co. of Middlesex, engineer for "*Improvements in meters for measuring water and other liquids.*" Aug. 17, 1870.

2297.—JOSEPH JUDGE HAYS, of Hertingforbury, in the co. of Hertford, gentleman, for "*Improvements in purifying, deodorizing, and utilizing sewage and other refuse and deleterious matters, and for machinery therein employed.*" Aug. 20, 1870.

2319.—FREDERICK HOLMES, of Gritton Terrace, Victoria Park, in the co. of Middlesex, for "*Improvements in pumps.*" Aug. 23, 1870.

2331.—ALBERT MARCIUS SILBER, of Wood Street, Cheapside, in the City of London, merchant, for "*Improvements in apparatus for lighting and heating purposes.*" Aug. 24, 1870.

2383.—ISHAM BAGGS, of High Holborn, in the co. of Middlesex, scientific chemist and engineer, for "*Improvements in steam and gas engines.*" Sept. 1, 1870.

2398.—JOHN WARD GIRDLESTONE, of 37, Norfolk Street, Strand, in the co. of Middlesex, for "*Improvements in 'dry' closets, commodes, urinals, and other receptacles for putrescible matter.*" Sept. 2, 1870.

2411.—GEORGE HASELTINE, of Southampton Buildings, London, for "*An improved recording pressure-gauge and alarm apparatus.*" A communication. Sept. 3, 1870.

2418.—ANDREW M'NIEL, of Tiverton, in the co. of Devon, engineer, and WILLIAM WHEATON, of Exeter, in the same co., merchant, for "*Improvements in the manufacture of salts of ammonia from ammoniacal gas liquor.*" Sept. 6, 1870.

2422.—THOMAS MURRAY GLADSTONE, of York Buildings, in the city of Westminster, mechanical engineer, for "*Improvements in chimney-tops and ventilators.*" Sept. 6, 1870.

2426.—CORNELIUS WILLIAM MORLEY, of 42, Clifton Road East, St. John's Wood, London, for "*Improvements in gas-burners and in the construction of the same.*" Sept. 7, 1870.

2433.—JOHN HENRY JOHNSON, of 47, Lincoln's Inn Fields, in the co. of Middlesex, gentleman, for "*Improvements in pipe-joints or couplings, applicable also to couplings for rods and shafting.*" A communication. Sept. 8, 1870.

2434.—TREAT TIMOTHY PROSSER, of Chicago, Illinois, U.S.A., engineer, at present residing at 198, St. Vincent Street, Glasgow, in the co. of Lanark, N.B., for "*A new or improved tube-expander and tube-cutter combined.*" Sept. 8, 1870.

2437.—GEORGE HENRY ELLIS, of 20, High Holborn, in the co. of Middlesex, engineer, for "*Improvements in steam, gas, and air engines.*" Sept. 9, 1870.

2460.—ALFRED TYLOR, of 2, Newgate Street, in the City of London, brass-founder, for "*Improvements in wet and dry closets, and in apparatus connected therewith.*" Sept. 12, 1870.

2472.—THOMAS ONION, of 12, Leicester Road, Loughborough, in the co. of Leicester, for "*Improvements in apparatus for measuring the flow of water or other liquids.*" Sept. 14, 1870.

NOTICES TO PROCEED.

1262.—JAMES ANTHONY EMSLIE, of Tarbert, in the co. of Argyll, gentleman, and JAMES THOMAS EMSLIE, of North Shields, in the co. of Northumberland, engineer, for "*Improvements in apparatus for lifting, forcing, or conducting liquids, gases, or air.*" May 3, 1870.

1295.—ABRAHAM RIPLEY, of 34, West Square, St. George's Road, Southwark, in the co. of Surrey, engineer, for "*A new or improved pipe-wrench.*" May 6, 1870.

1342.—JULES CROUZIÈRES, of Museum Street, Bloomsbury, in the co. of Middlesex, engineer, for "*An improved gas and water-tight joint to pipes and tubes.*" May 11, 1870.

1363.—HENRY LAW, of 15, Essex Street, Strand, in the co. of Middlesex, civil engineer, for "*Improvements in meters for measuring fluids, and in packings and counting apparatus to be used therewith, parts of which improvements are applicable to engines for obtaining motive power from fluids under pressure, and to other purposes.*" May 13, 1870.

Share List of Metropolitan Gas Companies.

Number of Shares issued.	Amount per Share.	Name of Company.	Amount paid up p. Share.	Dividend p. Cent. p. Annum.	Latest Quotations.
	£		£ s. d.	£ s. d.	£
8000	10	Anglo-Romano	10 0 0	10 0 0	11 — 12
5000	20	Bahia (Limited)	20 0 0	3 0 0	13 — 14
1000	20	Do., preference	20 0 0	10 0 0	25 — 27
750	20	Do., do., redeemable	20 0 0	10 0 0	20 — 22
40000	5	Bombay (Limited)	5 0 0	4 10 0	5⅜— 6
10000	5	Do., third issue	4 0 0	4 10 0	4⅝— 5⅛
10000	20	British (Limited) (Norwich, Hull-Sculcoates, Hanley, Tunstall & Shelton [Potteries], Trowbdge., & Holywll.)	20 0 0	10 0 0	30 — 31
7500	20	Cagliari (Limited)	20 0 0	7 0 0	
112000	10	*Chartered*	10 0 0	8 0 0	12⅛— 13
8000	10	Do., A shares	5 0 0	8 0 0	6⅛— 6⅞
10000	10	Do., B shares, 4 per cent. max.	10 0 0	4 0 0	6⅛— 7
25000	10	Do., 5 per cent. preference	4 0 0	5 0 0	5⅞— 6
20000	10	Do., 10 per cent. preference	10 0 0	10 0 0	18 — 19
17490	25	*Commercial*	25 0 0	10 0 0	39 — 41
20000	20	Continental Union	20 0 0	8 0 0	24 — 26
10000	10	Do., new	5 0 0	..	7⅛— 8⅛
5213	20	Do., preference	20 0 0	7 0 0	23 — 25
5000	10	*Crystal Palace District*	10 0 0	10 0 0	16 — 16½
5000	10	Do., preference	10 0 0	6 0 0	11 — 11½
10000	10	Do., new shares	10 0 0	7 0 0	12 — 12⅝
4000	50	*Equitable*	50 0 0	10 0 0	82 — 84
4000	25	Do., new shares	25 0 0	10 0 0	41 — 42
23406	10	European (Limited)	10 0 0	11 0 0	15 — 16
12000	10	Do., new shares (Boulogne, Amiens, Rouen, Caen, Havre, & Nantes.)	5 8 0	11 0 0	7⅛— 8
5000	10	Hong Kong (Limited)	10 0 0	9 0 0	11 — 12
26000	50	*Imperial*	50 0 0	10 0 0	80 — 81
26000	10	Do., new shares	7 0 0	10 0 0	12⅛— 13
26000	12½	Do., new shares	12 10 0	7 0 0	14 — 15
25000	12½	Do., new shares, 1870	2 10 0	7 0 0	3⅛— 4
1300	100	Do., bonds	£100	10 0 0	175 —180
56000	50	*Imperial Continental* (Amsterdam, Berlin, Ghent, Hanover, Lille, Rotterdam, Aix-la-Chapelle, Antwerp, Bordeaux, Brussels, Cologne, Frankfort-on-Maine, Haarlem, Stolberg, Toulouse, & Vienna.)	43 15 0	9 2 6	61 — 62
400	100	Imperial Mexican (Limited)	100 0 0	nil.	
200	100	Do., new	100 0 0	nil.	
3000	40	*Independent*	40 0 0	10 0 0	64 — 65
3000	10	Do.	10 0 0	5 0 0	7 — 8
3000	20	Do.	15 0 0	7 10 0	17 — 18
7133	50	*London*	50 0 0	10 0 0	82 — 84
5610	25	Do., 1st preference	25 0 0	6 0 0	28 — 30
503	50	Do., 2nd preference	50 0 0	6 0 0	
214	50	Do., 3rd preference	50 0 0	6 0 0	
£18781		Do., 1st preference stock		6 0 0	
£11828		Do., 2nd preference stock		5 0 0	
		Nictheroy, Brazil (Limited)			
15000	5	Malta and Mediterranean (Limited)	5 0 0	4 10 0	3⅛— 4
6000	5	Do., preference	5 0 0	7 0 0	4⅞— 5⅛
		Mauritius (Limited)			
30000	5	Oriental (Calcutta)	5 0 0	10 0 0	8 — 8⅛
30000	5	Do., new shares	1 10 0	10 0 0	3⅛— 3⅜
10000	5	Ottoman (Limited)	5 0 0	nil.	2 — 2⅛
14000	10	Pará (Limited)	10 0 0	10 0 0	10 — 11
27000	20	*Phœniz*	20 0 0	10 0 0	31 — 33
3600	100	Do., new	40 0 0	7 10 0	46 — 47
144000	Sk.	Do.	100 0 0	5 0 0	83 — 85
5000	20	*Ratcliff*	20 0 0	10 0 0	27 — 28
	20	Rio de Janeiro (Limited)	20 0 0	10 0 0	28 — 29
6959	5	Singapore (Limited)	5 0 0	7 0 0	
2000	5	Do., preference	5 0 0	7 10 0	
1500	32½	Shanghai	32 10 0	12 0 0	
4000	50	*South Metropolitan*	50 0 0	10 0 0	87 — 88
4000	12½	Do.	12 10 0	10 0 0	20 — 21
20000	12½	Do., new shares	1 0 0	10 0 0	3⅜— 4⅛
15000	10	*Surrey Consumers*	10 0 0	10 0 0	15 — 16
10000	10	Do., new	6 0 0	10 0 0	10 — 10⅛
9000	4	United General (Limerick)	4 0 0	5 0 0	2⅛— 2⅜
1500	10	*Wandsworth and Putney*	10 0 0	10 0 0	10 — 12
1500	10	Do.	10 0 0	7 10 0	
1819	10	Do.	10 0 0	7 10 0	
1138	10	Do.	5 0 0	7 10 0	
20000	10	Western (Limited) A shares	10 0 0	10 0 0	16 — 17
10000	10	Do., B shares	8 0 0	10 0 0	14⅛— 15
10000	10	Do., C shares	8 0 0	10 0 0	13 — 13⅛
20000	10	Do., D shares	1 0 0	10 0 0	2⅛— 3
16000	5	*West Ham*	5 0 0	7 10 0	7 — 7⅛
551	10	West London Junction (Limited)	10 0 0	6 0 0	
520	10	Do., preference	10 0 0	6 0 0	

THE

DUKE OF HAMILTON'S

LESMAHAGOW

CANNEL COAL.

LESSEES:

THE NITSHILL & LESMAHAGOW COAL COMPANY.

OFFICE:

37, ST. VINCENT PLACE,

GLASGOW,

Where all communications are requested to be addressed.

Price Current.

FREIGHTS.

Coastwise—Newcastle:—	Per Ton.	*Foreign:—*	Per Keel.
Chatham and Rochester	6s. 3d	Barcelona	£20 0s
Cork	5 6	Bordeaux	12 0
Dover, Folkestone, and Ramsgate	6 6	Boulogne and Calais	8 0
Dublin	5 6	Cadiz	12 0
Exeter Quay	8 0	Cronstadt	8 15
Ipswich	6 0	Copenhagen	7 10
London (from Leith)	8 6	Genoa	17 0
London (Pool)	5 9	Hamburg	—
Lowestoft and Yarmouth	4s. 9d. to 5 0	Havre de Grace	10 0
Portsmouth & Southampton	7 6	Leghorn	18 10
Plymouth	6 6	Lisbon	12 0
Shoreham	7 3	Rotterdam	7 0
Whitstable	6 9	Stettin	11 0
Weymouth	7 6	Trieste	19 0
		Venice	20 0

SUNDRIES.

Best Newcastle Fire-bricks, per 1000	£2 10s. to £2 15s. 0d.
Cliff's Fire-bricks (at Wortley), per 1000	2 15 6
Ingham's ditto (at Wortley), per 1000	2 15 0
Farnley Iron Co.'s Fire-bricks (at Wortley), less discount	2 17 0
Fire-clay Retorts, per foot run	5s. 6d. to 0 7 6
Tarred Rope Yarn, per cwt.	1 0 0

GAS COALS.

	Per Ton.
Newcastle—Unscreened:—	6s. 6d.
Haswells, Nettlesworth Primrose, and South Pelaw	
Pelling, Framwell Gate, North Pelton, Redheugh Main, Walker's Primrose, West Wear, and Whitwell Primrose	6 9
Burnhope, Craghead, Charlaw, Derwent, East Castle, Edmondsley, Eighton Moor, Hartlepool Pelaw, Holmside, Lambton's Gas, Lanchester Pelaw, Medomsley, Mickley, New Pelaw, Pelaw Main, Ravensworth, Seaham, South Moor Pelton, South Leverson, Townley Main, Tyne Main, West Pelaw, Wearmouth Hutton, and Witton	7
Peareth, Ravensworth Pelaw, Waldridge, West Garesfield, and West Pelton	7 3
Brancepeth, Dean's Primrose, Londonderry Gas, New Pelton, Pelton, South Peareth, Stella, Urpeth, Washington Hutton, and West Leverson	7 6
Ramsay's Newcastle Cannel	15 0
Wigan Cannel (at Liverpool)	17 0
Welsh Cannel:—	
Coppa Cannel (on rails at Birkenhead), 12s. 6d.; ditto (on rails at Connah's Quay)	13 0

Scotch Cannel, f.o.b.:—	Per Ton.	*Scotch Cannel*, f.o.b.:—	Per Ton.
Boghead—at Bo'ness, 47s. 6d.; at Leith	48s. 2d	Arniston (at Leith)	21s. 0d
Muirkirk	27 0	Wemyss (at Wemyss')	20 0
Kirkness, best (at Burntisland)	22 6	Haywood Co.'s Haywood (at Granton)	20 0
Capeldrae, 1st quality (at ditto)	22 6	Pirnie, or Methill	17 6
Ditto, 2nd ditto (at ditto)	17 6	Lothian's Cannel (at Leith)	24 6
Cowdenbeath (at ditto)	12 0	Grange ditto (at Bridgeness)	17 6
Lochgelly (at ditto)	12 0	Kinniel ditto (at Bo'ness)	17 6
Donnibristle—at Burntisland, 12s.; at Aberdour	12 6	Myles' ditto	23 6
Auchinheath Lesmahago (at Granton)	27 0	Lochore Parrot (at Burntisland)	22 6
Duke of Hamilton's Lesmahago (at Granton)	27 0	Lanemark (at Glasgow)	16 0
		Elphinstone Tower (at Leith)	20 0

Advertisements.

THE GAS-METER WORKS, KINGSLAND ROAD.

WANTED, a Resident Manager, to superintend the Manufacturing and Sale Departments. He must be a thorough business man, experienced in the management of large undertakings.

Address, stating age, salary required, past employments, and special qualifications, to GEORGE RAIT, Managing Director, Gas-Meter Company, Limited, 15, Coleman Street, City, LONDON, E.C.

WANTED, by the Sherborne Gas Company, a steady MAN, who understands the erection of fittings, the laying of mains and services, and of smith's work in general, and is thoroughly accustomed to the routine of a Gas-Work. Character from last employer required. Liberal wages will be given to a competent man.

Apply, with testimonials, to T. W. R. WHITE, Manager and Secretary.

WANTED, a thorough practical Man as METER INSPECTOR and PLUMBER to the Lowestoft Water and Gas Works.

Applications, stating qualifications and references, with wages expected, to be addressed to the MANAGER of the Water and Gas Works, LOWESTOFT.

N.B.—None but those with a really good character need apply.

WANTED, by the Advertiser, a situation as Manager, Inspector, Foreman, or Traveller. Has had great experience in gas matters, especially in the manufacture of wet and dry gas-meters. Is at present the inventor and owner of a most simple and effective patent for wet meter.

Address H. K., 90, Camden Street, LONDON, N.W.

WANTED, by a young Man, aged 21, a situation as CLERK or ASSISTANT to an Engineer. Has been for nearly five years in a Gas-Work in the Midland Counties. Can give unexceptionable references, and find any reasonable amount of security.

Apply to C. B. J., care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WORKING Manager Wanted, for small Gas-Works in the country. He must be prepared to work single handed in summer, with night-man in winter. Wages 21s. per week, with cottage and fuel. Must have had experience in sole charge.

State full particulars and age to Mr. A. HILL, Friar Street, READING.

EAST BARNET GAS AND WATER COMPANY.

(Incorporated by Act of Parliament.)

NOTICE is hereby given that the Directors are prepared to issue BONDS for sums of £100 and upwards, for Three years, at 5 per cent. per annum, payable half yearly.

Applications to be made at the Office.—By order,

W. C. HUMPHREYS, Secretary.

Office: Albert Road, New Barnet, Herts,
Sept. 12, 1870.

PHŒNIX GASLIGHT and COKE COMPANY.

NOTICE is hereby given that the adjourned HALF-YEARLY GENERAL MEETING of PROPRIETORS, holding previous to the 30th of June last £300 paid-up capital and upwards in the said Company, will be held, pursuant to the Act of Incorporation, on WEDNESDAY, the 28th instant, at Twelve for One o'clock, at the Bridge House Hotel, in the Borough of Southwark, for the purpose of declaring Dividends to the 30th of June last, to vary the time for closing the transfer-books, and on other business.—By order of the Court of Directors,

ISAAC ADOLPHUS CROOKENDEN, Secretary.

70, Bankside, London, S.E., Sept. 14, 1870.

TAR.

THE Directors of the Cambridge University and Town Gaslight Company are open to receive OFFERS for their produce of TAR, particulars of which may be had from W. WOOD, Manager.

New edition, 5th thousand, price 6d.

GAS ECONOMY. More Light on Gas, METERS, &c. By R. FERRIER, Royal Exchange, Edinburgh. "Most useful handbook." "Highly recommended."—*Mechanics' Magazine, Engineer, Journal of Gas Lighting, &c.*

Apply as above, HOULSTON & SONS, LONDON, and any Bookseller.

GAS TAR AND AMMONIACAL LIQUOR.

THE Directors of the Croydon Commercial Gas and Coke Company are prepared to receive TENDERS, on or before the 30th of September inst. for the TAR and LIQUOR made on their works from the 1st of October next, for a term of Three years.

Further particulars as to strength of Liquor and of carriage, &c., may be obtained at the Company's Offices, between the hours of Ten and Four o'clock.

By order of the Board,

WILLIAM PURVIS, Secretary.

Offices: 23, George Street, Croydon,
Sept. 23, 1870.

WANTED, a steady useful Man as SMITH and FITTER. One used to lead joints preferred.

Apply to Mr. JOSEPH STOKOE, Workshops, Lytton Road, NEW BARNET.

TO GAS COMPANIES AND ENGINEERS.

THE Advertiser, who has just returned from abroad, after completing the erection of a large Gas-Work, is open to a RE-ENGAGEMENT in a similar capacity, or as MANAGER for an English Gas Company. Has had 14 years practical experience (home and foreign) in the management, erection, and reconstruction of all plant appertaining to Gas-Works. Satisfactory references given to engineers and Gas Companies. Speaks the Spanish language, and has a good knowledge of Portuguese and Italian. Aged 34 years.

Address J. G. O. F., 98, Malden Road, Haverstock Hill, LONDON.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Elland-cum-Greetland Gas Company are prepared to receive TENDERS for the TAR and AMMONIACAL LIQUOR produced on their works for One or Three years, from the 11th day of October next.

Tenders to be sent to the Gas Office, Elland, on or before Oct. 7, 1870.

R. WEST, Secretary.

Gas Office, Elland, Sept. 23, 1870.

IMPORTANT TO GAS COMPANIES.

IN anticipation of the "Sales of Gas Act" coming into full operation, Messrs. BRADDOCK have prepared a LARGE STOCK of METERS, from Two Lights to Three Hundred Lights, which can be supplied on receipt of order.

Globe Meter-Works, OLDHAM.

CAST-IRON Retorts, Socket-Pipes, with Syphons, and all requisite Connexions, Lamp Columns, Wrought-Iron Tubing, Valves, Street-Lamps, Sight Holes, Furnace Doors, Ash-Pans, Charging and Coke Shovels, Iron Pails, Coke Barrows, Cross Bars, Fire Pots, Pumps, and Iron Borings.

PURIFIERS, CONDENSERS, & SCRUBBERS erected complete, or the materials supplied; and every description of goods in use by Gas-Works, in stock, at wholesale prices, at

Mr. LYNCH WHITE'S,

Old Barge Iron Wharf, Upper Ground Street, LONDON.

GEORGE NEWTON,

UNION STREET WEST, OLDHAM,

MANUFACTURER OF

IMPROVED WET & DRY CONSUMERS GAS-METERS,

GAS STATION-METERS,

With all the Joints planed,

GOVERNORS, GAUGES, INDICATORS, EXHAUST GOVERNORS, &c.

TERMS, &c., ON APPLICATION.

ECONOMY IN GAS PURIFICATION. A PURER GAS AT LESS COST, AND GREAT SAVING IN LABOUR.

M'DOUGALLS' PRECIPITATED PEROXIDE OF IRON.

The above Oxide is now in use at some of the largest works in the kingdom, and has gained a decided preference, owing to its efficiency' cheapness, and the great saving in labour effected by its use.

It is a pure artificial Hydrated Peroxide, with an addition of only sufficient sawdust to give it the needful lightness or porosity to prevent pressure, and every particle is available for use.

In selecting an oxide, a point more important than its price, is to learn the cost of labour entailed in its use. Whilst at large works the cost of labour for purifying, where lime alone or the natural oxides are employed, is 2d. to 3d. per ton of coals, by the use of the above Oxide it is reduced to 1d. to 1½d., owing to the purifier's working so much longer when charged, and to rapid revivification—two points of special importance in the busy season.

For export to Foreign Works it is unequalled, every particle being available, and saves freight over less concentrated materials.

NOTE.—It is important to note that only the Hydrated Peroxide of Iron is useful, simple oxide being worthless. Inferior oxides show a large per centage of simple oxide, but very little Hydrated Peroxide.

M'DOUGALL BROTHERS,

LONDON—11, ARTHUR STREET WEST, LONDON BRIDGE, E.C. MANCHESTER—68, PORT STREET.

1862.

PATENT ANTIMONY PAINT.

MADE ONLY BY

GEORGE HALLETT & CO.,

296, ROTHERHITHE, LONDON, S.E.

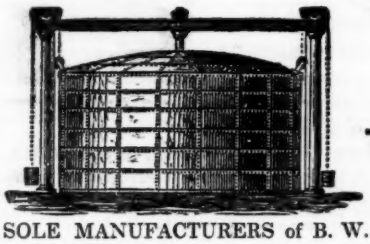
CLASS II.

This Paint having been in general use over eight years (especially in some of the principal Gas-Works), and proved itself the best light-coloured Paint produced for resisting the influence of vitiated atmospheres, it is important that its qualities should be more widely known.

It is not discoloured like white lead in a sulphuretted atmosphere, nor washed off like white zinc; and its light colour reflecting heat, produces much less expansion of gas in holders painted with it than with dark colours, besides rendering them much more sightly. Its specific gravity is so much below white lead that the same weight will cover one-third more surface, while it is equal in body; and its price being about the same (30s. per cwt.), it is actually one-third cheaper. From experience, its manufacture is greatly improved, and it is quite suitable for all purposes in which white lead is employed.

Reference is kindly permitted by the Engineers of the City of London, Commercial, London, and Surrey Consumers Gas Companies, who pronounce it the best Paint known for their purposes.

N.B.—Antimony Paint, COVERING SO MUCH MORE WORK, costs about 20s. per cwt., as compared with White Lead at 30s. per cwt.; a similar economy arises from its use in Steam and Gas Joints, for which purpose it is superior to White Lead.



IMPROVED GAS APPARATUS,

FOR CITIES, TOWNS, VILLAGES, &c.,

INVENTED AND MANUFACTURED BY

W. C. HOLMES & CO.,

WHITESTONE IRON-WORKS, HUDDERSFIELD.

SOLE MANUFACTURERS of B. W. THURSTON'S IMPROVED SCRUBBER, CONDENSER, and WASHER, in use in many of the principal Gas-Works on the Continent.

PATENTEES of the IMPROVED COMBINED PURIFYING APPARATUS, so eminently adapted for Exportation.

ESTIMATES, PLANS, and SPECIFICATIONS PREPARED for BUILDINGS and APPARATUS.

Prospectus, Price Lists, &c., on application.

LONDON OFFICES—57, GRACECHURCH STREET, CITY.

*** *Please address letters to Huddersfield.*

REFERENCES TO NEARLY 300 GAS-WORKS

LAMBERT BROTHERS, WALSALL.

ALPHA TUBE & FITTING WORKS

CAROLINE VICKARY,

(ADMINISTRATRIX TO THE LATE JOHN VICKARY,)

GAS ENGINEER, CONTRACTOR, IRON AND BRASS FOUNDER,

EXE ISLAND, EXETER,

(Established Thirty years,)

Respectfully tenders her thanks to those friends who have patronized her since her late husband's death, and having secured an efficient staff for each department of design and manufacture, she refers with confidence to works recently erected by her as a guarantee that all orders she may be favoured with will be completed in a sound and satisfactory manner.

GASHOLDERS AND TANKS,

Retorts, Retort-Fittings, Condensers, Scrubbers, Purifiers, Station-Meters, Governors, Sluice-Valves of all kinds. (Gas and Water Mains always in stock.)

GAS-FITTINGS,

Including Chandeliers, Pendants, Hall Lamps, Brackets, Star and Sun Lights of all designs, embracing the Mediæval and other periods.

GAS-METERS (WET OR DRY),

Combining the most recent improvements in principle and manufacture; upwards of 150,000 already in work, giving the highest satisfaction. (A guarantee for five years given with each one.)

Every description of **Plumbers Work,** comprising **Water-Closets, Beer-Engines, Lift and Force Pumps, Cocks for Gas, Water, or Steam, &c.**

Drawings, Specifications, and Estimates of **Gas-Works, Iron Roofs, Bridges,** and light or heavy structures in wrought or cast iron, supplied on application.

CANNEL COAL.—The West Yorkshire Iron and Coal Company, Limited, beg to draw the attention of Gas Companies to their Cannel, of which the following is the analysis made by W. Huggon, Esq., F.C.S.:

Yield of gas per ton	10,296 cubic feet.
Illuminating power rather over	21 sperm candles.
Yield of coke per ton . .	12 cwt.

The actual working, as reported by one of the largest gas companies in Yorkshire, gives results still more favourable, viz.—

Yield of gas	10,416 cubic feet.
Illuminating power	21·89 sperm candles.
Coke	The same.

We add from the same source the capabilities of the common gas coal—

Yield of gas	10,080 cubic feet.
Illuminating power	14·41 sperm candles.
Yield of coke	13 cwt.

COLLIERIES—WEST ARDSLEY, near LEEDS.

For further particulars, address to the Office of the Company, 15, York Place, LEEDS.

POPE & PEARSON'S GAS COAL.—We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles.*

One ton yields 12¼ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near LEEDS.

OLD WEMYSS CANNEL COAL.—Yield of gas per ton, 12,896 cubic feet; illuminating power, 31·75 standard candles. Port of shipment, Wemyss.

Analysis and price on application to Mr. WM. CAREY, Manager, Wemyss Colliery, Kirkcaldy, FIFE.

CANNEL COAL.

MESSRS. GRIFFITHS BROTHERS,
COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their Cannel for gas-making purposes.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 32-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to GRIFFITHS BROTHERS, Coppa Colliery, Mold, FLINTSHIRE.

THE
HUCKNALL COLLIERY COMPANY
Can offer a CANNEL COAL yielding a large quantity of Gas of superior quality.

Prices and information on application to the HUCKNALL COLLIERY COMPANY, Hucknall Torkard Collieries, near NOTTINGHAM.

THOMAS EDINGTON & SONS,
PHŒNIX IRON-WORKS,
GLASGOW,
Manufacturers of all kinds of
GAS AND WATER PIPES,
Branches, Bends, Water-Traps, Tank-Plates, Valves, and general Castings. Also
RAILWAY CHAIRS & SLEEPERS,
AND
GRIFFIN'S PATENT PERMANENT WAY.
London Office, 63, Old Broad Street.

WALTER MABON & CO.,
Engineers,
ARDWICK IRON-WORKS,
FAIRFIELD STREET, MANCHESTER,
MANUFACTURERS OF
IRON TANKS, GASHOLDERS,
GAS APPARATUS,
PIPES, VALVES, IRON ROOFS,
WROUGHT AND CAST IRON GIRDERS.
DESIGNS, SPECIFICATIONS, & ESTIMATES FURNISHED.

FIRE-CLAY GAS-RETORTS, &c., CANNEL AND STEAM COALS.

WILLIAM FRASER, Inverkeithing (owner of the Works at which Fire-Clay Retorts were first made), having greatly enlarged his Works, can supply RETORTS and other FIRE-CLAY GOODS to any extent.

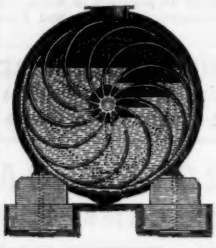
References can be given to managers of above a hundred Gas-Works whom he supplies.

WILLIAM FRASER ships COWDENBEATH PARROT COALS at Charlestown and Burntisland at 11s. per ton; and HALBEATH STEAM COALS, on Navy List, at 7s. per ton.

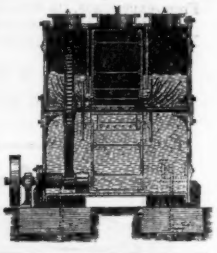
INTERNATIONAL EXHIBITION, 1862.
CLASS X.
PRIZE MEDAL
For excellence of Fire-Clay Gas Retorts, and
"HONOURABLE MENTION" for good quality of Fire-Bricks.
WILLIAM STEPHENSON & SONS,
THROCKLEY,
NEWCASTLE-ON-TYNE.

J. T. B. PORTER & CO.,
GAS ENGINEERS,
MANUFACTURERS AND CONTRACTORS FOR GAS-WORKS
Of any extent at Home and Abroad,
GOWTS BRIDGE WORKS, LINCOLN,
AND
JOHN STREET, ADELPHI, LONDON, W.C.

WALTER FORD,
159, GRAY'S INN ROAD, LONDON,
MANUFACTURER OF
WET & DRY GAS-METERS, STATION-METERS, GOVERNORS, &c.
SOLE MANUFACTURER OF
PADDON'S PATENT STREET-LAMP REGULATORS,
For ensuring any required consumption. These Regulators are in general and increasing use, and references can be given to Gas Companies who use them for every Lamp.



HANNA DONALD & WILSON
GAS ENGINEERS,
ABBEY WORKS, PAISLEY.
LONDON OFFICE:
9, FENCHURCH STREET, E.C.
MAKERS OF
WHIMSTER'S PATENT COMBINED GAS EXHAUSTING & WASHING MACHINE.
Information and prices on application.



ROBERT DEMPSTER,
Gas Engineer and Contractor, Rose Mount Foundry, Elland, near Halifax.

R. D. recommends his Fire-Brick Retorts to Engineers and Managers of Gas Companies; they last from 10 to 12 years.

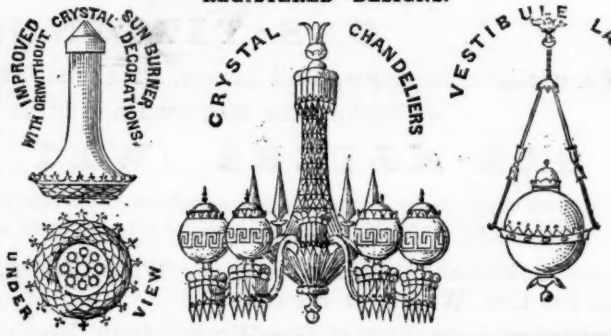
Iron and Fire-Clay Retorts.	Wrought-Iron Tubes, Water Tanks.
Annular and Pipe Condensers.	Wrought-Iron & Cast-Iron Roofs.
Scrubbers and Purifiers, all sizes.	Gasholders, Single-Lift or Telescopic.
Steam-Engines and Exhausters.	Gas Castings of every description.
Hydraulic Centre-Valves.	Retort Setters and Fitters sent to all parts of the country.
Station-eMters and Governors.	Wood Sieves for Purifiers.
Photometers & Pressure-Gauges.	
Lamp-Posts and Brackets.	
Cast-Iron Mains and Syphons.	

Plans and Specifications prepared.

WILLEY & FORD,
GAS ENGINEERING WORKS, EXETER,
CONTRACTORS FOR THE ERECTION OF GAS-WORKS,
MANUFACTURERS OF IMPROVED WET & DRY METERS;
Also, EVERY DESCRIPTION OF GAS APPARATUS,
Comprising GASHOLDERS, STATION-METERS, GOVERNORS, CONDENSERS, PURIFIERS, RETORTS, SLIDE-VALVES, and every article appertaining to Gas-Works.
Gas Companies advised on Improvements, Extensions, and Alteration of Works.
*** The very best material and workmanship guaranteed, and at prices bearing a favourable comparison with any House in the Kingdom.

SAMUEL CUTLER & SON,
CONTRACTING GAS ENGINEERS, &c.
MANUFACTURERS OF GASHOLDERS, TANKS, PURIFIERS,
AND ALL DESCRIPTIONS OF GAS-MAKING APPARATUS.
Iron Roofs, and General Iron Work. Mains Supplied and Laid.
S. C. & SON supply every requirement for a Gas-Work, and keep in stock Retort-Lids, Cotters, Barrows, Scoops, Bolts and Nuts, &c., &c.
PROVIDENCE IRON-WORKS, MILLWALL, LONDON, E.

TO GAS COMPANIES AND THE TRADE.
J. DEFRIES & SONS,
MANUFACTURERS OF
CRYSTAL, BRONZED, & ORMOLU CHANDELIERS, IMPROVED CRYSTAL STAR & SUN LIGHTS, AND THE PATENT CRYSTAL ILLUMINATION;
Vestibules, Iron Barrel, Composition Tubing, Dry & Wet Meters, & Gas-Fittings
OF EVERY DESCRIPTION.
WORKS: LONDON, BIRMINGHAM, & PARIS.
REGISTERED DESIGNS.



Special Designs prepared in perfect accordance with architectural arrangements. Estimates furnished for the Lighting and Fitting up of Theatres, Music Halls, and Public or Private Buildings with Gas.

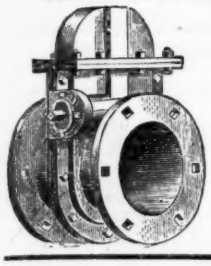
Gas Moons of the newest designs.

The Patent Gas-Regulator and Purifier reduced to 6s. 6d. per Doz.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1870, are now complete.

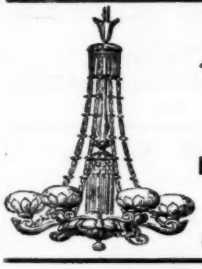
City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.
ESTABLISHED 1803.

REDUCED PRICES
OF
B. DONKIN & CO.'S
IMPROVED GAS-VALVES
WITH WROUGHT-IRON PINIONS,
From 2 inches to 18 inches, price 9s. 6d. to 12s. per inch diameter.



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.
These Valves are all proved on both sides to 30 lbs. on the square inch before leaving the works, and are always kept in stock.
VALVES MADE WITH OUTSIDE RACKS TO ORDER.
ALSO,
SCREW WATER-VALVES WITH GUN-METAL FACES.
B. DONKIN & CO.,
GENERAL ENGINEERS AND IRONFOUNDERS,
MAKERS OF STEAM-ENGINES,
BERMONDSEY, LONDON, S.E.

A. C. FRASER, F.S.A.,
GAS AND CONSULTING ENGINEER,
COLCHESTER, ESSEX,
INVENTOR & PATENTEE of CAST-IRON & FIRE-CLAY RIBBED RETORTS.
Mr. Fraser having had more than Twenty years experience in the Construction, Alteration, and Management of GAS and WATER WORKS, will be happy to furnish information on all matters appertaining thereto.
Plans, Specifications, and Estimates prepared.



F. & C. OSLER,
45, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.
ESTABLISHED 1807.
MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,
WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.
TABLE GLASS OF ALL KINDS.
CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

JAMES MILNE & SON,
GAS ENGINEERS,
Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,
EDINBURGH, AND
2, KING EDWARD STREET,
NEWGATE STREET, LONDON.
Station-Meters, Governors, Consumers Meters, Gas Lustres, Chandeliers, Brackets, &c., and every description of Gas-Fittings and Gas Apparatus.

GEORGE ANDERSON,
GAS AND CONSULTING ENGINEER,
19, NORTHUMBERLAND STREET, STRAND, W.C.
MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.
PATENTEE and MANUFACTURER of the following Inventions:—
RETORT SETTINGS, heated by tar without the production of smoke.
STEAM-ENGINES and EXHAUSTERS, separately or combined.
FOUR-WAY VALVES, one of which is equal to three ordinary Valves.
STATION GOVERNORS—the Gasholder cannot tilt and cause accident.
BREEZE AND TAR FUEL MACHINE.
A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d.
N.B.—The second edition of this Work, *now ready*, contains illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.
"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artizan.*

SCHOLL'S
PATENT PLATINUM
GASLIGHT PERFECTER.

Extract from Report by Dr. Letheby:—
"The results have been very remarkable, for they show an average increase of 63 per cent. on the illuminating power of the gas. I am of opinion, therefore, that the invention is of great practical value."
Price 1s. each for Fishtail Burners.
To be had retail of Gas-Fitters and Ironmongers, and wholesale of
JOHN SCHOLL, 41 & 42, BERWICK STREET, OXFORD STREET,
LONDON, W.
Terms on application. N.B.—A specimen sent free on receipt of Twelve stamps.
. Further testimonials from Drs. Frankland and Crooks, showing the great practical value of this invention will be shortly published.

PRICE'S PATENT COKE & COAL BARROW,

effecting a great saving of time, labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Gas-Works, HAMPTON WICK.

HOPKINS, GILKES, & CO.,
LIMITED,
MIDDLESBOROUGH,
SUPPLY GAS & WATER PIPES of EVERY SIZE.
Plain, Turned and Bored, and Coated.
CAST-IRON RETORTS.
Castings for Gas-Works of every description.
EXHAUSTERS.
LONDON OFFICE: 95, CANNON STREET

NAPHTHALINE
IN GASHOLDER INLET-PIPES.
With Livesey's Patent Man-Lid these Pipes can be examined and cleansed without loss of Gas, with the greatest facility and without any risk.
Cost of the Apparatus, to cover two 18-in. pipes, about £10.
Royalty: At the rate of 1s. per foot diameter of each Gasholder, and no further payment.
LIVESEY'S SYSTEM OF WATER-VALVES
FOR PURIFIERS
Will effectually prevent that contamination of the pure Gas which so frequently occurs where the ordinary Valves are used. They are much less costly, easily applied, and, being simple castings, cannot well get out of order, while by their use it is found that the Gas will bear a continuous test for Sulphuretted Hydrogen for an indefinite time.
Application to be made to the Patentee, GEORGE LIVESEY, Engineer, South Metropolitan Gas-Works, S.E., where both inventions are in use.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET,
DURHAM.
Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.
Agent in London, Mr. J. MANWARING, 101, Cann Street, E.C.

THOMAS LAMBERT & SONS,
SHORT STREET, LAMBETH, LONDON,

PATENTEES OF THE
HIGH-PRESSURE EQUILIBRIUM BALL VALVES AND DIAPHRAGM BIB & STOP VALVES,
MANUFACTURE EVERY DESCRIPTION OF
GAS-JOINTS, CHANDELIERS, PENDANTS, BRACKETS, ETC.;
WROUGHT-IRON
WELDED TUBE AND FITTINGS,
BLACK AND GALVANIZED;
BRASS, COPPER, LEAD, TIN, AND COMPOSITION TUBING,
STOCKS, TAPS, AND DIES,
And Every Description of Gas-Fitters Tools;
CAST-IRON GAS-MAIN COCKS,
WITH PATENT METAL PLUGS;
GAS SLIDE AND SLUICE VALVES;
CARTER'S SAFETY GAS-VALVES
GAS-STOVES, REGULATORS, BURNERS, &c.,
Large Pattern-Book and Price List of Gas-Fittings, price 7s. 6d., supplied on application.

JAMES NEWTON & SONS,
(Established 1820,)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.,
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY,
and every Article suitable for
GAS AND WATER WORKS.

T. EVANS & SONS, Retort-Setters and GAS-OVEN BUILDERS, having done the work at various Gas-Works in England and Wales for many years, can be well recommended. Testimonials and references on application.
Communications to be addressed to the Gas-Works, Cannock, near STAFFORD.

SCOTCH CANNEL COALS.
The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.
JAMES M'KELVIE,
CANNEL COAL MERCHANT,
HAYMARKET EDINBURGH.
Established 1840.

Now publishing,

BAILEY'S ILLUSTRATED INVENTIONS,

With Illuminated Cover and over 300 Engravings.

Price 1s.

This book is replete with information, and prices of many well-known as well as perfectly new inventions, interesting to all in the mechanical trades, as well as corporations, governments, gas managers, private gentlemen, and shopkeepers.

Post free in the United Kingdom, 1s.

JOHN BAILEY AND CO., Albion Works, Salford, LANCASHIRE.

TURNER & ALLEN,

201, UPPER THAMES STREET

LONDON, E.C.

MANUFACTURERS OF

LAMP PILLARS,

BRACKETS,

GAS LANTERNS,

FOUNTAINS.

HOT WATER AND GAS ENGINEERS.

Contractors for the supply of Lamp Columns, Lamps, Fountains, &c., to Gas, Water, and Railway Companies, Local Boards, Shippers, &c.

Complete Pattern and Price Book, 3s. 6d. in Stamps.

THOMAS PROUD,

GAS ENGINEER,

Invites attention to his

ALL-PLANED PARALLEL & TAPER BAR

WOOD GRIDS

FOR PURIFIERS,

And respectfully states that he has erected improved Steam Machinery for their manufacture, and devotes great care to manufacture Grids which will give satisfaction both in quality and price.

He also solicits attention to his

IMPROVED GAUGE

which indicates pressure or vacuum in ONE TUBE, the supported or depressed column of water giving the exact reading at a single glance. Mounted on a neat mahogany bracket, and having but one joint, the Gauge can be taken asunder, cleansed, and refixed in a few minutes.

Plans and estimates furnished for improvement of existing, or for the erection of new Gas-Works.

Sole Agent to

GEORGE SKEY & COMPANY, Limited,

For FIRE-CLAY RETORTS.

Gas Apparatus Manufactory,

7, UNETT ST., ST. GEORGE'S,

BIRMINGHAM.

C. & W. WALKERS'

WOOD SIEVES FOR PURIFIERS.

These justly celebrated Sieves, with bevel bars and hard-wood side frames, have been extensively made by Messrs. Walker for over seven years, and their advantages and durability are fully established. Messrs. Walker make them in very large quantities, having mills and machinery specially laid out for them, producing them at the most moderate cost.

MIDLAND IRON-WORKS,

DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

8, FINSBURY CIRCUS, LONDON, E.C.

HANCOCK'S INDIA-RUBBER GAS-TUBING.

All sizes, from ⅛ in. to 4 in. diameter and upwards.

Also,

HORSE SINGEING APPARATUS, best make, with GAS-BURNERS, COMBS, and INDIA-RUBBER TUBING, all complete.

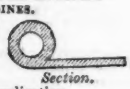
INDIA-RUBBER BAGS for GAS-MAINS.

WASHERS for GAS and STEAM JOINTS.

VALVES (pure solid Rubber) for STEAM-ENGINES.

PACKING (Elastic) for STEAM-ENGINES.

FLANGE TUBING, for excluding Draughts and Dust through WINDOWS, DOORS, and GLASS CASES.



Section.

Illustrated Price Lists on application.

JAMES LYNE HANCOCK,

Vulcanized India-Rubber Works,

GOSWELL MEWS, AND 266, GOSWELL ROAD, LONDON, E.C.

THORNELOE AND COMPANY,

34, LONDON WALL, LONDON, E.C.,

GAS AND WATER ENGINEERS,

AND

CONTRACTORS FOR GAS AND WATER WORKS APPARATUS.

SHOW-ROOMS AND WHOLESALE WAREHOUSE FOR

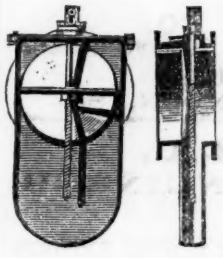
Wrought-Iron Tubes & Fittings for Gas, Water, & Steam; Chandeliers, Pendants, Lamps and Brackets, Plumbers Work, Water-Closets, Pumps, &c. Lead, Composition, Brass, and Copper Tubes.

PATENTEES OF THE

NEW FLEXIBLE VALVE

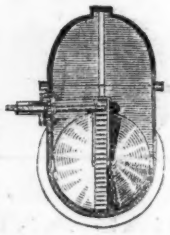
FOR

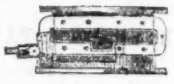
GAS & WATER WORKS.



This Valve has been designed to meet what has hitherto been felt a great want, in Gas-Works especially—namely, a *really tight* Valve which could be depended upon.

The new Valve is simple in construction, not liable to get out of order, cheap in price, and the principle can be adapted to every part of Gas Apparatus where a Valve is required.





Drawings, Price Lists, and further information sent on application.

Agents for

Messrs. NEWTON, CHAMBERS, & Co.,

THORNCLIFFE IRON-WORKS, CHAPELTOWN, near SHEFFIELD,

MANUFACTURERS OF

Gas Apparatus, Gasholders, Scrubbers, Condensers, & Purifiers; Iron Main-Pipes, Valves, & Fittings for Gas and Water; Wrought-Iron Retort-Lids; Wrought & Cast Iron Girders. Bridges, Piers, &c.

FULLERTON, SON, & CO.,

GAS-METER MANUFACTURERS,

LONDON ROAD METER-WORKS, EDINBURGH,

SOLE MANUFACTURERS OF

THE PATENT IMPROVED TIN-PLATE DRY METER;

With special facilities for adjusting and repair, the principal parts of the mechanism being accessible by the removal of a single screw.

Gas-Meters on the Wet and Dry principles made in Cast-Iron and Tin-Plate Cases.

Station-Meters, Governors, Experimental & Test Meters, Gas Apparatus, &c.

LONDON AGENTS:

THORNELOE & CO., 34, London Wall, City, E.C.,

Where Meters are supplied to order from Stock.

TO GAS COMPANIES, ENGINEERS, BUILDERS, &c.

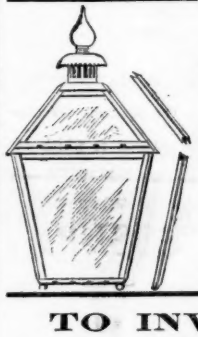
THE PATENT ANTI-GALVANIC PAINT

Is guaranteed to prevent and arrest Rust on all Ironwork, and to cover Tar most effectually. It is most valuable for protecting it from the action of salt water, rain, sulphurous and gaseous exhalations. It has been well tested at various Gas-Works, in covering Tar on Gasholders, Purifiers, &c., and has given great satisfaction.

Testimonials given if required, and sample cans for trial sent free of charge.

All communications to be addressed to

Messrs. STEVENS & CO., 156, CHEAPSIDE, LONDON.



GAS COMPANIES & LOCAL BOARDS

Requiring New Street-Lamps are recommended

KEEN'S PATENT DOUBLE-CLIP STREET-LAMP.

TESTIMONIAL.

"Dear Sir,—I am very pleased to say we are quite satisfied with your Patent Lamps, and consider them to possess decided advantages over the ordinary Street-Lamps; and although we cannot undertake to throw out of use our existing old-fashioned lamps, we purpose applying yours to all new columns, as well as replacing the old ones found to be worn out.

(Signed) "JOHN READ, Secretary.

"*Tunbridge Wells Gas Company, Dec.* 13, 1869."

For particulars of price, &c., apply to

EDWARD JEEVES, Manufacturer, WEYBRIDGE, SURREY.

TO INVENTORS & PATENTEES.

MR. W. H. BENNETT,

Having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 42, Parliament Street, WESTMINSTER. [Office of the JOURNAL OF GAS LIGHTING, &c.]

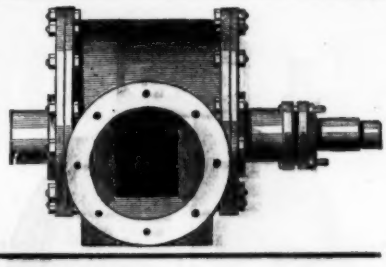
ROTATORY AND DOUBLE-ACTING GAS-EXHAUSTERS,

With many recent improvements, from 1500 to 150,000 cubic feet per Hour.

JAMES BURTON, SONS, & WALLER,

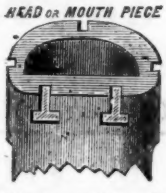
MAKERS OF ENGINES, MACHINERY, and IRONWORK for GAS-WORKS,
Efficient and durable TAR, LIQUOR, and SYPHON PUMPS,
GAS-VALVES, with or without Wedges, worked with powerful Worm and Rack,
SELF-ACTING BY-PASS VALVES, with Lid and Relieving Lever,
ROTATORY, TUMBLER, and CAPILLARY WATER DISTRIBUTORS for SCRUBBERS.
SMALL-SIZE EXHAUSTERS KEPT IN STOCK.

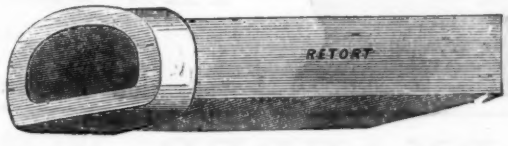
JOHN'S PLACE, HOLLAND STREET, SOUTHWARK, LONDON, S.E.



KING BROTHERS,

STOURBRIDGE FIRE-BRICK AND RETORT WORKS.





KING BROTHERS beg especially to call the attention of Gas Companies to the superiority of their Retorts, which are made from the celebrated STOURBRIDGE FIRE-CLAY. Mr. King has patented a Kiln for burning Retorts, by which Patent all Cold Air is excluded from the Kiln while burning, thus rendering them FREE FROM CRACKS AND CORRECT IN FORM. By great care in Manufacturing, combined with the advantages in burning, a VERY SMOOTH SURFACE is obtained, rendering them less liable to carbonize.

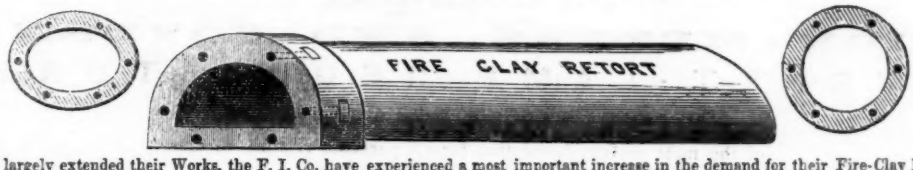
Retort Ovens, Fire-Bricks, Guards, Saddles, Rabbitted Bars, Flues, and Quarries, are all Manufactured of the same quality of Clay.

Every Retort and Brick is branded "King Brothers, Stourbridge."

Agent in Ireland—Mr. JAMES FURNESS, No. 3, FOWNES STREET, DUBLIN.

THE FARNLEY IRON COMPANY,

FARNLEY, near LEEDS.



Since they so largely extended their Works, the F. I. Co. have experienced a most important increase in the demand for their Fire-Clay Retorts, which they owe chiefly to the superior quality of their make, and to the facilities they now possess for executing orders promptly, either for *home* or for *export*.

The Fire-Clay raised from the Farnley Estate (commonly called the Wortley bed) is unsurpassed by any other known in the district, and is peculiarly well adapted for Retorts, Gas-Ovens, and Fire-Bricks; and the F. I. Co. beg especially to invite those connected with Gas-Works, who have not yet used their Retorts, to be good enough to favour them with a trial.

The F. I. Co. generally hold in stock, for immediate supply, Fire-Bricks of every size and kind—Tiles, Sanitary Tubes, Ornamental Terra-Cotta Ware White Facing Bricks, the White, Buff, and other Glazed Bricks and Tiles, in various colours and shapes, &c., as well as the Brown Salt-Glazed Bricks, &c., &c.

Prices, Drawings, and all other information may be obtained by applying as above, or to

MR. SUTTON, THE HULL STORES, 46½, QUEEN STREET, HULL.

PARIS, 1867.

CLASSES 24 and 53.

WILLIAM SUGG,

GAS ENGINEER.

LONDON, 1862.

CLASSES 13 and 31.

PUBLIC LAMP GOVERNORS, LEVER COCKS, AND POLE LIGHTERS,

LAMP METERS AND BOXES.

LOWE'S JET PHOTOMETERS CAN NOW BE RATED TO 14 CANDLES.

VINCENT WORKS, VINCENT STREET, WESTMINSTER, S.W.

Established

1795.

JOSEPH CLIFF & SON,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS.

NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

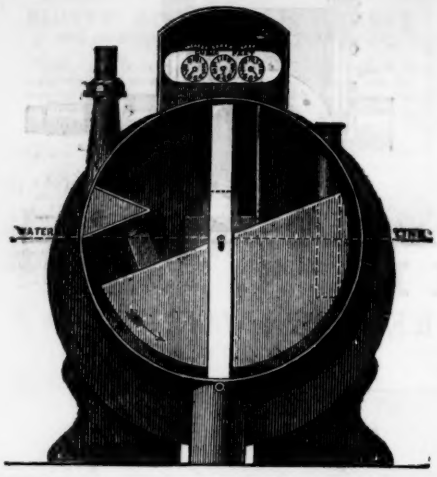
FIRE GOODS, and Salt-Glazed Drain-Pipes.

LONDON AGENT:

MARCUS BOURNE NEWTON,

Wharf No. 4, inside Great Northern Goods Station, King's Cross, N

Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.



THE
UNVARYING WATER-LINE GAS-METER.
(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."

Over 60,000 in action.

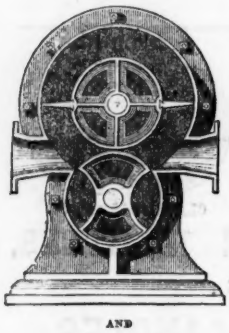
MANUFACTURERS:

THE GAS-METER COMPANY,
KINGSLAND ROAD, LONDON;
WITH
Branch Manufactories at DUBLIN and OLDHAM.

ALEXANDER WRIGHT & CO.,
MANUFACTURERS OF
WET METERS,
COMPENSATING WET METERS,
AND
IMPROVED DRY METERS
of the very highest excellence.
STATION-METERS AND GOVERNORS.
STREET-LAMP REGULATORS.
TESTING APPARATUS
of the most perfect description for all purposes relating to Gas.

55 and 55a, MILLBANK STREET, WESTMINSTER, S.W.

LAIDLAW'S PATENT GAS EXHAUSTER



AND
ROTARY PUMP.

R. LAIDLAW & SON,
GAS ENGINEERS, CONTRACTORS, IRON & BRASS FOUNDERS,
Iron-Works and Foundries, GLASGOW,
Meter-Works & Brass Foundry, EDINBURGH,

Manufacturers of GASOMETERS & GAS APPARATUS of EVERY DESCRIPTION; CAST-IRON PIPES, all sizes, cast in DRY SAND and VERTICALLY by PATENT MACHINERY; IRON ROOFS, COLUMNS, BEAMS, & GIRDERS; BOILERS, TANKS, & CISTERNS; VALVES, Screw, Rack and Pinion, &c., for Gas and Water, with Iron or Gun-Metal Facings, &c.; WROUGHT-IRON TUBE and FITTINGS for Gas, Water, or Steam; GAS-METERS (Wet and Dry) of the most approved Construction, STATION-METERS, GOVERNORS, &c.; GASELIERS, BRACKETS, PENDANTS, PILLARS, & GAS-FITTINGS of every description; LAMP-POSTS and LANTERNS for Streets, &c.

London Address: SOUTHWARK STREET (near Gt. Guildford St.), BORO', S.E.

D. HULETT and CO., 55 and 56, HIGH HOLBORN, LONDON,
PATENTEES and MANUFACTURERS of the ONLY GOOD MERCURIAL GAS REGULATOR,

Invite the attention of Gas Companies and the Trade generally to their Improved GAS-METERS, which they warrant equal to any in Quality, Workmanship, and Simplicity of Construction, and the only Meters from which Gas cannot be obtained without being duly registered.

MANUFACTURERS
GAS CHANDELIERS, GLASS LUSTRES, HALL LANTERNS, VESTIBULES, BRACKETS, PENDANTS;
DOUBLE CONE, ALBERT, SHADOWLESS, & EVERY DESCRIPTION OF BURNER, UNION JETS, BATSWINGS, ETC.;
IMPROVED FULL-WAY CARTER'S VALVES (much approved of);
GAS-STOVES, and every article connected with Gas Apparatus.
CAST & WROUGHT IRON PIPE, BLACK & GALVANIZED. COPPER, TIN, BRASS, & COMPOSITION TUBING.
D. HULETT'S IMPROVED SERVICE CLEANSER
for clearing out Mains, Services, and Interior Fittings—65s. net.
Boyle's Patent Silvered Glass Combination Reflectors and Outside Lanterns
Sole Manufacturers of Church and Mann's Photometer.
Large Pattern-Books, with every description of Gas-Fittings, Chandeliers, &c., with complete Book of Prices, 12s.

London: Printed by WILLIAM BOUGHTON KING (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street); and published by him at No. 11 Bolt Court Fleet Street, in the City of London.—Tuesday, September 27, 1870